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The Farmer's Digest

Volume 9 November, 1945 Number 7

Inside the Cow's Udder

Condensed from The Jersey Bulletin

W. E. Petersen

University of Minnesota

From an economic standpoint the cow's udder might be said to be the most important unit in agriculture because nearly one-fifth of the total farm income in the United States comes from milk. As a contributor to human well-being, the udder of the cow is most important, for nutrition authorities agree that milk and milk products are essential in a good diet.

From the standpoint of activity and complexity of its processes, the udder of the high-producing cow is unexcelled by any other gland. Each year, good cows usually produce 10 times their weight in milk, and exceptionally good cows have produced 20 times their weight.

There is still much to be learned about the complex processes of making milk in the udder. Few dairymen appreciate the complexity of the machine that they are dealing with daily. A better knowledge of the structure, growth, development, and functioning of the cow's udder not only will bring a better appreciation of the work the cow is doing but will also form the basis for better management of this important gland.

Because of the hundreds of years of selection for high milk production, the mammary glands of the good dairy cow are proportionately better developed than in any other species. How this development has taken place is best understood by briefly considering the more important known facts about (1) the evolution of the mammary glands, (2) development before birth, and (3) development after birth.

From studies of the most primitive mammals, as well as from embryologic studies, there is good evidence that the mammary

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glands are modified skin (sweat) glands. In the simplest of the living mammals, the egg-laying echidna of Australia, the mammary glands look like sweat glands located on the abdomen. There are no teats. The milk from each of the 100 to 150 glands oozes out of a pore much like sweat gland pores, and the young lick the milk off the hair upon which it collects.

Evidence of the next step in the evolution of the glands is furnished by another egg-laying mammal, the duckbill platypus, in which a number of ducts join to form a common opening in the skin, but there is not a teat. In animals such as the opossum and kangaroo comes the first evidence of the development of teats. In the simpler forms there are many teats and many ducts running through the teat, each to an opening in the end.

The development of the mammary gland from this point on has been combining more glands into one, development of a gland cistern into which the ducts drain, and a reduction of the number of ducts in the teat to just one in the case of the cow.

Science produces further proof that the mammary gland is a skin gland. When the bovine embryo is about two-thirds inch long, the single layer of skin cells in the region of the udder starts multiplying and becomes many cells deep. From this multiplication of the cells, the embryologist has traced the development of the teats and the ducts of the gland. At first the cells form solid masses. One mass becomes the teats, and others (sprouts) extend into the tissue. These solid masses of cells canalize or open up in the center to form the teat cistern and ducts.

At birth there is no essential difference in the development of the mammary glands of the bull and heifer calf. The small gland is mostly fatty tissue with a very limited duct development. In the male there is little change in the mammary gland development with maturity, but in the normal heifer progressive changes take place with increase in age.

With each recurring estrus or heat cycle, the gland becomes larger. The growth is due to an increase in fat tissue and an increase in both the size and number of ducts. In a 15-months-old non-pregnant heifer the tissue is mostly fat and the milk cisterns are as yet poorly developed. A microscopic examination would reveal no alveoli (milk secreting structures). Development in this stage is due to the secretion by the ovary of a hormone known as estrogen.

After pregnancy the estrogen secretion increases causing a more rapid development of the duct

system, and another hormone (progesterin) secreted by the yellow body (corpus luteum) of the ovary comes into play. In rats progesterin causes the development of the alveoli and in all probability does the same for the cow, although this has not been proved.

While estrogen and progesterin are the main hormones involved in the growth and development of the mammary gland, they are by no means the only ones. Secretions of the pituitary gland, the thyroid, and several other glands are needed for a fully-developed udder. Nutrition also plays a part in mammary gland development.

The normal cow's udder consists of four glands or quarters arranged two on each side dividing the udder into fairly distinct "halves." These halves are separated by a membrane and, except for some connecting veins, are independent of one another. The two quarters on either side are also independent of each other, and the milk produced in one quarter cannot be drained out of the other. There is, however, no discernible membrane separating the two quarters of a half.

Other things being equal, the amount of milk a cow can produce depends on the size of her udder. Poor udder quality or failure to secrete the necessary hormones may prevent a cow with a large udder from being a high producer, but a large udder is essential for high milk production. Udder size varies greatly. Udders from mature cows have been recorded weighing but a few pounds to over 80 pounds.

Individual quarters vary greatly in size. On the average the front quarters make up about 40 and the rear quarters 60 per cent of the total weight of the udder. There are cases where the reverse may be true. The rear quarters are not as wide as, but much deeper than, the forequarters. The rear quarters also are usually longer from front to rear than they are wide. This makes it impossible to judge the relative sizes of the quarters from external examination.

The main supporting structure holding the udder to the body is the median suspensory ligament. This is a tough ligament arising from fibers coming out of the lower abdominal wall and sending fibers into each half of the udder. Additional support for the udder is provided by the lateral suspensory ligament, a tough membrane covering most of the top of the udder and extending part way down the sides. The skin covering the udder also assists in supporting the udder to the body, especially when the udder is distended with milk.

When fibers in the supporting

ligaments become stretched or broken, the udder breaks away from the body and becomes pendulous. Strong udder attachments are of great importance because broken attachments and pendulous udders are unsightly and more subject to injury.

Normally each quarter has a teat for expressing the milk. Teats vary greatly in size and shape, the ideal teat being 4 inches long and 1½ inches wide. Absence of hair from the skin of the teat is the only distinguishing line between the teat and the udder when the quarter is funnel shaped. At the end of the teat is an opening known as the streak canal which connects with the inside cavity of the teat. The streak canal is kept closed by ring-like muscles (sphincter muscles) that encircle it at the end of the teat. Milking is effected by applying enough pressure to the teat filled with milk to force open these ringlike muscles. When these muscles are too strong, the cow is a hard milker. When they are weak, the milk may leak out.

From 20 to 55 per cent of cows have supernumerary or accessory teats. Supernumerary teats usually do not secrete milk, but occasionally they may be quite troublesome. The supernumeraries are most commonly located behind the rear teats. However, they may be between the fore and rear teats, to the fore of the front teats, or they may actually branch from either front or rear teats.

The internal structure of the udder can best be dealt with by tracing backward the path over which the milk has come, beginning with the teat and going back through the gland cisterns, ducts, secretory structure, and lobes. Consideration of the circulation and nervous connections logically follows.

The teat consists of a wall, a cistern, and a streak canal. While the wall of the teat varies in thickness, a quarter of an inch is representative when the teat is distended with milk. The outside of the teat is covered with skin while the inside is lined with a delicate membrane. The rest of the wall consists of muscle and connective tissue as well as blood vessels. The teat wall is elastic, contracting so that the walls become thicker when emptied of milk and expanding when filled with milk.

The streak canal is from one-third to one-half inch long. It is lined with a continuation of the outer skin, which is arranged in longitudinal folds that interlock when the canal is closed and which allow the canal to open without stretching the lining. Beginning at the upper end of the streak canal, the test cistern extends upward through the teat to the gland cistern from which it is

separated by a circular fold of the membrane lining the teat. This fold serves as a dintinguishing line between the teat cistern and the gland cistern. In some cases the fold may extend into the cistern so far that it interferes with the free passage of milk from the upper chamber into the teat cistern.

The gland cistern is an irregularly-shaped chamber for collecting and storing milk that may vary in capacity from one-half pint to one quart. The cistern is lined with the same type of membrane as is the teat cistern. Frequently its outer walls may contain small milk secreting glands.

Radiating out from the cistern walls are from 20 to 50 or more large ducts which branch out innumerable times until finally the branches become microscopic in size. They are then known as ductules. The secretory structure of the very smallest branches or ductules ends in an enlargement known as the alveolus. The alveoli are the chief place for the secretion of milk, although some secretion may take place in the lining of the ducts and ductules. The arrangement of alveoli in relation to a small duct and its branching ductules resembles a bunch of grapes in which the grapes are the alveoli and the stems are the ductules. The inside of each alveolus is lined with a single layer of cells that synthesize and secrete the milk. As these cells elaborate the milk, it is secreted into the alveolus where it is stored until withdrawn by milking. The outer walls of each alveolus are connected with a fine network of blood vessels from which the cells get milk-making materials.

Each quarter is divided into several small units known as lobes. A lobe is that part of the udder that is drained by a duct. Therefore, a quarter contains as many lobes as it has ducts. The lobes are further divided into lobules. A lobule represents the part of the lobe drained by a branch of the main duct.

Other things being equal, the producing capacity of an udder is proportional to the number of alveoli that it has. The number of alveoli present in any part of the udder varies greatly depending upon the amount of other tissue present, which may be determined by inheritance or udder disease.

In the lower part of the gland, as the ducts become larger, there is more connective tissue than in the upper part where the ducts are smaller. The walls of the larger ducts contain large amounts of connective tissue.

Frequently the alveoli are destroyed by mastitis and replaced

by connective tissue which in this case is the same as scar tissue.

An udder that contains a large amount of connective tissue feels firm and "meaty." The udder of good quality is soft and spongy.

Since all milk comes from blood, the circulation of blood in the udder is of great importance. About 400 gallons of blood must pass through the udder for every gallon of milk produced. The circulation to the udder consists of the arteries which bring in the blood, the veins which carry it out, and the lymph system.

Arteries—The blood for each half of the udder comes in through a single artery which enters the udder from above at a point midway between the halves and about one-third way from the rear side. Here the artery divides into two branches, one for the fore quarter and one for the rear. As it progresses through the quarter, each branch divides and subdivides innumerable times until the smallest branches or capillaries afford close contact with every cell to supply it with blood.

Veins—After the arterial blood has given up its oxygen and nutrients to the cells and has picked up from them the carbon dioxide and other waste products, it must go back to the lungs to be purified and renewed. Here the udder's system of veins comes into operation, the venous capillaries taking the stale blood from the cells and passing it along through larger and larger branches until it reaches the main veins which carry it to the lungs. The veins leading from the udder follow three different routes. One, known as the abdominal mammary or milk vein, goes forward just under the skin of the belly. A larger one extends upward parallel to the main artery, while the third and smallest of these veins runs backward from the udder and then upward under the skin to enter the body through the pelvic arch. Either of the two large veins can carry away all of the blood that enters the udder. Tying off of the mammary vein does not reduce the milk production as the other veins have ample capacity.

Lymph System—Lymph or tissue juice is produced in all tissues and is returned to the blood stream through a special system of ducts and lymph glands which filter the lymph. Lymph ducts in the udder reach every minute part. These ducts consolidate into larger and larger ducts in much the same way as the veins. In the udder the flow of lymph is first downwards from the smaller vessels and then upward and backward into the lymph glands, one of which is located on the upper rear side of each half. The lymph gland is usually about the size of a walnut and can be felt from

the rear. When there is infection in the udder, the lymph glands may become many times the normal size.

Most of the vein-like structures under the skin of the udder are lymph vessels and not blood vessels as commonly supposed. The swelling of the udder and abdomen before and after calving is due to the backing up of lymph in these tissues.

The nerve supply to the udder is too complex for detailed discussion here. It must suffice to point out that each half of the gland proper is supplied with nerves from a nerve trunk which enters the udder near the main artery and branches to follow the arterial system of the gland.

The skin of the udder and teats is richly supplied with nerves coming from the spinal column by way of the abdominal wall. The nerve endings in the skin of the udder and teats are of great importance in milking because they pick up sensations that ultimately result in the letdown of the milk. Presumably, endings for all skin sensations—touch, pain, cold, and hot—are to be found here.

In addition to the functional supernumerary teats there are many abnormalities of the udder, a few of the more important of which will be briefly discussed as follows:

Blind Quarters — Frequently heifers well come in with one or more quarters completely inactive. For some unknown reason the gland tissue failed to develop and nothing can be done to correct the deficiency.

Fistulated Teats — The teat often may have an extra opening, known as a fistula, through which milk may leak. This fistula may be adjacent to the streak canal or may be located on any part of the teat. A veterinary surgeon can cauterize and get rid of teat fistulas.

Leaky Teats—Frequently the sphincter muscles around the streak canal may be injured or are too weak to withstand the pressure of accumulating milk and the milk will leak out. This condition can also be corrected by skilled surgery.

Hard Milkers—Hard milkers have too strong sphincter muscles or too much connective tissue around the streak canal. Skilled surgery can correct this condition.

Teat Spider — Sometimes a wart - like growth, commonly known as a spider, takes place in the teat cistern. It may be located on any part of the teat cistern wall and causes difficulty when the growth is large enough to stop the milk from getting through the streak canal. It requires skilled surgery to remove a spider.

Absence of Teat Cisterns—Occasionally, for unknown reasons, one or more teats may not have cisterns, the teat being a solid mass of tissue. There is no remedy.

Obstruction of the Gland Cistern — Although rare, the udder cistern may be separated from the teat cistern by a membrane. A skilled veterinary surgeon can correct this condition by cutting the membrane.

Accessory Glands on Teats or Udder—Sometimes small secreting glands without teats may be found on the teat and udder. In some cases there is no opening and the gland will be engorged with milk following calving. The swelling soon subsides as the milk is resorbed. When the milk is released through an opening (fistula), the condition becomes a nuisance and the gland should be destroyed by a veterinarian.

The udder may be affected by injuries and a number of diseases, including mastitis, none of which can be discussed here.

An Extra Crop of Lambs

Though sheep production is not a large enterprise in New Jersey, it can be made a profitable side line on general farms because the eastern market will pay a premium for locally grown lambs of the right weight and finish. Many farmers feel, however, that the birth of only one lamb a year requires too much feed for such a small return. With this thought in mind it seemed desirable to determine the possibility of inducing estrum in ewes during the spring and to determine whether the ewes would conceive following this artifically induced estrum.

In the first trial, ten ewes, 3 and 4 years old, were injected with 5 c.c. of gonadin. Six of the ten lambed the following fall. Twenty-five yearling ewes were also injected, and five of these lambed in the fall. The 11 ewes which had lambed in the fall bred normally the same fall and lambed again in the spring. These ewes after weaning their lambs were bred again in the fall of the second year, giving three crops of lambs in 2 years. This project has been enlarged this year in cooperation with the owner of a large commercial farm flock who has made about 100 ewes available for study under normal farm conditions.

—*New Jersey Agriculture*

Fall Topdressing

Condensed from New England Homestead

Ralph W. Donaldson

FALL is the time to apply the annual topdressing. The condition of meadow and pasture land is then most favorable for treatment.

After a season of prolonged growth sod may need liberal treatment. Abundant growth the past season is bound to remove in harvest more plant food from soils than normal. Unless effort is made to return such nutrients, soil fertility, in consequence, will be lower and affect yield adversely next season.

Fall is a more convenient period than spring, for most dairymen to apply their fertilizer topdressing. After crops are harvested work is less pressing. Usually the ground also is drier. Areas invariably too soft or wet in early spring often can be readily treated in the fall.

The most common fault of spring treatments is delay in making them. Reasons for delay usually are soft ground, late arrival of fertilizer, or simply procrastination. If nitrogen is involved and stimulation of the early crop is the object, late applications may be an utter disappointment, unless moisture is present to make the fertilizer work in time. Late applied fertilizer may lie on the surface unused when a dry spell follows with no rain to carry the fertilizer to the roots. Thus most of the dry parts of the field gain no immediate benefit. Farmers frequently derive too little benefit from late applications during dry springs when feed is needed most. Such men are skeptical about spending money for fertilizer and say the practice rarely works.

Very early spring treatments formerly were stressed with the object of allowing opportunity for rains or early spring moisture to dissolve and carry fertilizer to the hungry roots. There is no time to be wasted in the growing period of herbage plants! We have all seen grasses start to "green up" on fertile spots the minute frost starts to leave the ground.

A more certain way now to avoid unpredictable delay in making the spring application is fall treatment before ground

Reprinted by permission from the New England Homestead, Springfield, Mass., August 25, 1945

freezing. This affords good opportunity for penetration and the full growing period from frost till harvest for the crop to benefit. Moreover fall topdressing has worked both for a dry and for a wet spring.

For the dry spring of 1944, a comparison of fall vs. spring treatment was made at the Massachusetts State College. The treatment in this instance happened to be 7-7-7 applied at a 700-pound rate on adjacent strips on a poorish 8-year-old grass sod. Fall treatments at two dates were compared with one in early spring. These were October 15 and November 19th (after ground freezing), 1943, and April 10, 1944. The respective yields of the first cutting were 4250, 4000 and 3750 pounds of dry hay per acre, with 2350 pounds from the unfertilized check. The advantage of fall topdressing is indicated for that dry season over an early spring treatment (fortunately made before the rains stopped). There were farmers that spring who applied topdressing unfortunately in late April after dry weather set in and they saw no response from their treatment.

Last fall's applications certainly worked for this season's wet spring. The practice was adopted by a great many farmers. There is evidence from a number of demonstrations as well. One fertilizer company alone carried out several hundred trials throughout New England of two acres each of fall treatment which gave outstanding results. Over 80 of these trials conducted in Massachusetts applied a 900-pound rate of 7-7-7 per acre last fall. This treatment has averaged considerably more than a ton of extra hay over the average farm manure treatment. When compared with untreated areas the yield in some instances doubled or trebled.

Manure may be the major source of fertility but the amount is not enough—not to grow top yields of all the silage, hay, and pasturage needs of an efficiently stocked enterprise. Too much of the soil fertility consumed as feed is sold off the farm in dairy products or is likewise lost in ordinary handling of manure. A figure of $10 or more per cow might be estimated lost per year in fertility elements even after making due allowance for those obtained through purchased grain. A fair measuring stick of forage production efficiency, in fact, is often reflected in the *dollars spent per cow* for fertilizer to build up hay and pasture yield.

Most dairymen fertilize generously the corn using at least one-third of the manure pile on not over one-seventh of all feed crop acres. Corn "phosphate" too is

used. By comparison, what manure is left for maintenance of all the hay and pasture land is insignificant — little more than a strong smell, maybe every other year!

Here is where a fertilizer investment counts. An expenditure of say $10 per cow in appropriate fertilizer would make some impoverished fields more profitable to farm. Some such item ranging from $10 to $20 is the amount per cow several topnotch dairymen have told me they spend for lime and fertilizers to produce good roughage crops.

After all the efforts and expense of establishing new seedings, it seems criminal to starve them soon into weeds and impoverishment, when annual treatment might save them and double their productiveness. Treatments to be effective must start while the stand is still good. To revive run-out fields, plowing, refitting and seeding is commonly the best plan.

Those sods of two years and older in hay and grazing often comprise the great bulk of feed crop acreage on most New England farms. It is the acre-yield of this large area that makes or breaks the feed supply. Numerous tests over various years have shown that grass hays may be increased about a ton per acre by use of fertilizer. This possibility of increase from many suitable acres of sod is an important means for augmenting tonnage. With treatment also one may expect sods to remain productive more years. The final appeal to the dairyman may be this—there is no simpler practice for increasing yield than by topdressing.

Seeding from Straw

When E. C. Stevens spread a ton of alsike straw on 4 acres in Pettis county, Missouri, he got the best legume stand he ever had. There was an acre more in the field than the straw would cover. He put in 6 pounds of seed on it, and got a stand about half as dense at that obtained from the straw.

—Capper's Farmer

The Eye and Hand in Judging

Condensed from The Shorthorn World

Dr. Carl W. Gay
Ohio State University

JUDGING livestock is regarded too often as a simple matter of inspection and then a more or less casual inspection at that. In reality there is much more than the inspection involved. Judging consists of measuring to a standard, and inspection by itself means little, unless there is in the mind's eye of the judge an ideal with which to compare the individuals upon whom judgment is to be passed. The decisions of the judge will deserve and receive little consideration unless the ideal to which he is measuring as a standard is correct. Correction of one's standard of measurement is accomplished by checking with show-ring awards and sale-ring tops, as well as through personal contact with breeders, dealers and packers, and by keeping informed on consumer demand which should not be ignored by the producer of beef. Furthermore, the judge must possess a broad, open mind, free from prejudice, and the courage of his convictions, even in the face of differences of opinion and criticism, so that decisions will be accepted as authoritative, even though all exhibitors may not be in agreement.

Time marches on in the livestock business, too, and types shift from time to time. One may have a good eye for seeing cattle, but if he is placing up the same type and weight of cattle as won for him maybe thirty-five to forty years ago. his decisions will be badly misleading. For instance, when Peerless Wilton's 39th Defender was made grand champion steer at the 1906 International Livestock Exposition, the comment was caustic and critical. Peerless Wilton's 39th Defender was a calf eleven months old, weighing 975 pounds, while the shows at that time were still classifying two-year-olds, some of which weighed over 1800 pounds. He was the first calf to win this championship, breaking a long precedent, and that was the basis of the criticisms. The judge, Arthur P. Turner, an Englishman, had been amply vindicated by subsequent events and might now be accepted as a prophet. He evidently sensed the beginning of

Reprinted by permission from The Shorthorn World, Aurora, Ill., June 25, 1945

the trend toward more early maturing light-weight cattle and was a pioneer in the cause of baby beef, which now dominates not only our fat classes but is recognized as the favored type in the breeding cattle division. The older age classes were later dropped by the shows, and on the present weight classification 1400 pounds is the limit.

I describe all this to show how standards of excellence, so to speak, change and, therefore, how important it is to keep the judges' and the breeders' ideals which constitute the objective toward which they are working, corrected to date. It will be seen from this, I trust, that the competent judge must have more than a good eye and touch to qualify. It is something like the physician or surgeon who may take but a short time for a diagnosis and treatment or an operation in surgery, which seem simple yet represent years of study and experience spent in acquiring the skill required. Discharging acceptably a show-ring judging assignment may be the crowning achievement in the career of one whose life-time experience is what fits him for the job.

Having acquired the correct ideal or standard by which to measure, then judging IS largely a matter of inspection and the technique employed is the next logical consideration. Both the eye and hand are depended upon in ascertaining the make-up of an animal, and their relative importance and use is the theme of this story.

Horsemen have an expression, "Cast your eye over him," which could well apply to cattle since it is of this that the first step in making observations actually consists. This is just another way of expressing the procedure of taking the whole animal into one's field of vision, so that it can be seen in perspective. A close-up view does not permit of such. The judge notes the general things in the appearance of the animal, i.e. scale, type, lines, balance and style. The counterpart of the horseman's quotation, "Cast your eye over him," is "He fills your eye," and that means he measures up to the standard therein established. The effectiveness of this general view is greater if the animals can be seen on the move. For convenience in the show-ring, a preliminary once-over close-up is usually completed before the animals are moved, although it is more logical to study the bigger features first and then finish the inspection with a careful detailed examination of everything that relates to conformation, quality, substance, natural fleshing and condition.

Thus far a visual study of the animal is all that has been made. Usually, "seeing is believing," but in judging it is not always feasible to believe what is seen without some confirmation, and this is made possible by handling. The rule is to observe all that can be seen with the eye—then confirm by the use of the hand. The extent to which the eye and the hand are depended upon in judging livestock will vary with the class of stock judged. In working hogs the eye tells it all with the exception of a possible touch to determine firmness, lifting an ear to examine the eyes or feeling the udder to count the teats.

In dairy cattle a handling of hide and hair to learn quality and condition and udder texture is about all for which the hand is used.

Horses are handled regularly to determine some unsoundnesses which are not always visible, as side bones, and it is quite common to run the hand over the hocks and down the tendons. Any unsoundness or enlargement in these regions can usually be seen, but the fingers are more sensitive to impressions of this sort than the eye and are used to supplement the latter. Also one touch at mid-rib is quite in order to determine how much and what kind of fat the horse carries.

Beef cattle are regularly handled more than anything else except sheep, since the actual thickness of fleshing, its consistency and uniformity can be told accurately in no other way. To the practiced hand, the resilient, live rubber "feel" of the crops, loin and rib indicate a wealth of natural flesh amplified by the feeder's skill in the interspersion of fat into the substance of the muscle (marbling), as well as an even accumulation of fat under the hide (bark in the carcass). Either too firm, hard, pit-on-pressure covering or too soft and ripply flesh indicate an over-ripe condition, as does the uneven deposition of fat in rolls or patches. While these contrasts are most marked in the fat steer, they are discernible, though in less degree, in breeding cattle fitted for show or sale.

Sheep, of course, are at the other extreme from hogs—their form and other features are so obscured by the fleece that a most comprehensive system of handling them has been worked out. It is impossible to see all that is to be known of a sheep in the fleece. Therefore, the hand is more to be depended upon here than in any other livestock.

The use of the hand, like the eye, in making the observations necessary to judge livestock, should be used in a systematic manner. Moreover, the judge

should concentrate on the touch he is making, in order to sense fully what he feels and avoid having to repeat. It should also be remembered that the tips of the fingers are the most sensitive to touch.

Study of the dressed carcass aids in cultivating a discriminating "touch." A standing rib roast, for instance, has as a foundation the parts of the skeleton included in that cut, i.e. the segments of the vertebra sawed in half and about ten inches of ribs. Mounted, as it were, upon this base are the long back muscle that is recognized as the "eye of beef" with the broad, flat muscles extending down over the ribs. The muscles are bound together and to the bones by connective tissue and thickened by the marbling and external fat. All four of these tissues—bone, muscle, connective tissue and fat—compose meat as we know it, although of the four, muscle is the criterion by which "meatiness" is gauged.

Better Than Fallow?

If you're a dry-land grain farmer, would you like to raise crop yields 50%, raise three crops, instead of two, in four years, and do a better job of stopping wind erosion?

Farmers in Lewis County, Idaho, are doing just those things. Here's how it all started, and how they do it.

About ten years ago word got around Lewis County that young Joe Lux, just turned 23 and starting to farm his own, was harvesting nearly twice the usual wheat yields on his 600-acre farm. How was he doing it? Simply by *substituting sweet clover for summer fallow in the rotation and plowing the legume under as a green manure crop.* Joe figured the soil needed a "tonic" to boost yields as well as a cover crop.

Neighbors followed suit. Now about one acre in ten of Lewis County's 15,000 cropland acres is in sweet clover. The idea is paying off. In 200 field checks, wheat on fields that had been in sweet clover out-yielded the grain-following-fallow fields by better than 12 bushels an acre—40.6 to 28. Barley was even more convincing —46.6 bushels following sweet clover, 31.5 for summer fallow

Sweet clover is usually seeded with barley as a nurse crop, and plowed under in the bloom stage the following year. Winter wheat is seeded that fall, frequently followed by a crop of peas, and then the ground returns to the sweet clover-barley starting point.

—Farm Journal

Insect Control of Weeds

Condensed from Pacific Rural Press

Clyde Simmons

MAN'S well being sometimes rests on curious trifles. Take, for example, the future of some hundreds of thousands, perhaps millions of acres of range and other productive lands in the north half of California.

If three varieties of imported insects find things to their liking in that part of California, Klamath weed may be ultimately controlled. If they don't—well, other sorts may turn up.

The three "bugs" are "Chrysolina hyperici" and Chrysolina gemellata," leaf eaters and "Agrilus hyperici," which makes himself at home boring into the stem of the Klamath weed.

The three came to the U. S. A. via Australia and were introduced by Prof. Harry S. Smith, University of California entomologist, in cooperation with the United States Dept. of Agriculture. Their ultimate destiny is Klamath weed control. Whether they fulfill that destiny only time can tell.

You see, explains Prof. Smith, biological control is about the only way a real control could be devised for Klamath weed for economic reasons. Spraying row crops or dusting them, or even the kind of wide-scale dusting made possible by the use of the newly developed dust gun, is entirely feasible on specific crops for their protection. But when it comes to control of a weed growing over range areas—chemical control as now known, at least, probably isn't feasible.

But what is known as Klamath weed which the English know as St. John's wort, can be and is controlled biologically. In Europe, this weed is widespread, but insect pests hold it in check.

Years ago it spread to Australia. Without the European insects to hold it, the weed ran wild. So Australian scientists trekked to Europe to find out why the pest was worse there than in its native land. In due course, and after some 30 or 40 different insect species had been studied painstakingly, the search narrowed to the three named above. So they were imported into Australia. There they found things to their liking and thus far give every promise of holding the weed in check.

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Sounds easy? It isn't. For it's necessary, in such cases, not only to find out which insect eats the pest, that's the simple half of the equation, it is even more necessary to know what else the chosen "bug" dines on, or what he would eat, given the opportunity. Klamath weed, it happens, belongs to a plant family whose other members are of no economic importance. Even so, before the species brought here could be turned loose, they had to be subjected to starvation tests on many potential "host" plants to be sure they were Klamath weed family addicts exclusively.

These tests, says Prof. Smith, have been completed for at least one of the three species and a first release of insects was made this May past in Marin and Placer counties. The scientists must now wait for months, perhaps years, to learn the outcome after other such releases have been made.

Biological control of weed pests isn't new to Australia. The "down under" continent had even more trouble with prickly pear cactus. At the peak of its spread—it was introduced as a potential cattle feed—some 60,000,000 acres had been pre-empted by the cactus. Then the "Cactoblastus" moth was introduced. To date more than 20,000,000 acres have been reclaimed for productive use.

Speaking not long ago before the Southern California Entomology Club, Prof. Smith warned that Southland areas may face the same peril from this type of cactus. He cited areas in Los Angeles county and the Channel islands as examples. His belief is shared by at least one man, Ed Stanton, owner of one of the islands, where the prickly pear has become an otherwise insoluble problem. So "Cactoblastus," too may come to California in quantity.

Corn Silage Makes Valuable Cow Feed

Condensed from The Southern Planter

Dr. Fred H. Leinbach

THERE is more feed value in an acre of forage stored as silage than when saved in any other form.

For a number of years the Maryland Agricultural Experiment Station has been conducting feeding experiments with corn silage. The first series were set up to determine the place of silage in steer fattening rations. Steer calves weighing in the neighborhood of 400 pounds were used. All lots of cattle were full-fed grain. One lot was fed hay, only, as their roughage ration; another hay and corn silage, in approximately equal parts by weight. Here is a summary of the results. The silage-fed steers looked better, ate better and sold at a higher price. But better yet, feeding silage in this proportion brought about a decided lowering of feed costs. Two and fifteen hundredths (2.15) pounds of silage were worth as much as one pound of hay in this comparison.

Another lot of steers was fed a heavier corn silage ration. Their roughage feed consisted of 4½ parts of corn to 1 part of hay. The first year a good grade of alfalfa hay was fed and there was no advantage from feeding the larger amounts of silage. But when the experiment was repeated and a hay of decidedly lower quality was fed, the heavy silage ration gave the best results.

Silage feeding did not lower the market value of the steers but it did materially lower the cost of producing gains. From the feeder's angle that is a most important consideration.

If silage is a good roughage feed for fattening cattle, how good is it as a feed for beef breeding cows? To answer this question another experiment was conducted. This extended over a two-year period and included two wintering periods and one pasture season.

One group of cows was fed corn silage supplemented with small amounts of lime (.1 pound per cow daily) and soybean oil meal (.65 pound per cow daily). Corn silage is low in lime and protein and when fed alone should be supplemented. Another group of cows was fed all the mixed clover-light-timothy hay they would eat. Cows in both

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groups were grain fed after calving, during the first winter at the rate of 6 pounds per cow, daily; during the second winter, at the rate of 3 pounds per cow, daily.

A number of your readers saw these cows on experiment. Without knowing how the groups were being fed, each of you picked the silage fed group as the better. The final results tell the same story.

During the first winter the silage fed cows gained weight; the hay fed cows lost weight. During the second winter both groups gained in weight. The gain made by the silage fed cows was much greater, however. The silage fed cows always looked better; their hair coats were more glossy; they had more vigor; they showed more bloom. Calves born to cows in this group averaged almost 15 per cent heavier at birth; they gained faster after birth even though both groups of calves were creep fed. The average birth weight of the calves from the silage group cows was almost the same both years. The calves born to the hay group cows were 7 per cent lighter the second year than the first. The silage fed cows were also more regular in breeding. Every cow dropped a calf between the close of the first wintering period and the second wintering period. Only two out of three cows in the hay group calved in the same period, although of those which didn't all but one were heavy in calf when the experiment ended.

A further advantage of silage feeding was in lowering winter feed costs. If hay were to be charged at $20 per ton and soybean oil meal at $60 per ton, silage had a replacement value of $8.55 per ton in these wintering experiments. Add to this further value derived from having heavier calves at birth, faster gaining calves, thriftier, more regular breeding cows and the value of silage is still greater.

Increased production and utilization of silage means more total feed production and better, more economical rations for our livestock.

Laying Flock Management

Condensed from Everybodys Poultry Magazine

Morley A. Jull

PROFITS made from the laying flock depend far more on common sense methods of management than most flock owners realize. Except for diseases such as fowl typhoid and fowl cholera, most of the "bad luck" about which so many flock owners complain is due to negligence in management.

If you want to make the most profit from your flock this fall and winter, consider these six important factors that affect profits:

1. *High annual egg production per bird.*

Without high egg production for the year, you cannot expect to make even reasonable profits, especially when feed prices are relatively high. Well bred stock and common sense management are necessary to secure high production.

2. *High percentage of pullets in the laying flock.*

Many commercial market egg producers in the Northeast keep pullets only. Under average conditions, yearling hens lay about 20 per cent fewer eggs than pullets. From the standpoint of pounds of feed per dozen eggs produced, pullets on the average are more efficient than yearlings. On the other hand, if your flock is used for breeding purposes, it would be well to keep some carefully selected yearlings each year from which to secure pullets for laying flock replacements.

3. *High fall flock egg production.*

High fall egg yield means higher profits because egg prices are highest in the fall. Early maturing pullets hatched at the right time lay better in the fall than yearlings and thus provide more income. Common sense flock management is relatively more important in the fall than at other times.

4. *Low mortality.*

Dead birds provide no further income from the flock. The most expensive time for a pullet to die is just when she is ready to start laying. You get no returns on the feed she consumed nor on the labor and overhead costs you have spent on her. Therefore, keep mortality low, especially in fall and early winter.

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5. *Efficient use of labor.*

No one likes to work for nothing. But flock owners who neglect their birds often wind up the year with a *flat* pocketbook instead of a *fat* pocketbook. The only difference between flat and fat is "l," which stands for laziness. It's the lazy flock owner who does not plan his work to save steps in the chore route and who forgets to do the little things that affect the comfort of the birds and the number of eggs they lay. Moreover, with labor short on many poultry plants, your work should be planned more carefully than ever so that all labor will be used efficiently.

6. *Low overhead costs.*

Keep overhead costs as low as possible. In former times, some poultrymen sank too much of their invested capital in expensive buildings so that interest on investment was excessive. At present, however, there are practically no new laying houses being built, and other overhead items such as taxes and insurance are not an outstanding source of worry to the efficient flock owner.

Six Management Steps

Now that we have considered the six fundamental factors on which success in the laying flock enterprise is based, let's consider six steps in management that affect profits secured from the flock.

1. *Foresight sense in culling at housing time.*

Due largely to the shortage of red meats, there were many late-hatched pullets produced this year. There will be grave danger of a lot of immature pullets being housed this fall. Many of these pullets won't pay for their keep. In fact, in normal times many poultrymen do not cull their pullets rigidly enough at housing time.

Workers at the California Experiment Station, for instance, took a flock of pullets reared on range to the laying house and graded them into grades 1, 2, and 3 on the basis of their physical condition at housing time. All pullets were put in the laying house and records of production kept during the first laying year. At the end of the year grade 1 pullets averaged 182 eggs, grade 2 pullets averaged 151 eggs, and grade 3 pullets averaged 63 eggs.

When you house your pullets this fall, cull those lacking a bright prominent eye, lustrous plumage, and good fleshing, and don't put small-sized pullets in the laying house. After you think you've done a good job of culling, cull another 10 per cent.

Common sense in culling regularly simply means observing the flock closely from day to day and culling out the birds that you can see will lower the efficiency of the

flock. That doesn't mean that you should cull every pullet as soon as she ceases laying, because quite a number of these temporary non-producers are still capable of making some money, as workers as the New Jersey Experiment Station have shown. On the other hand, cull rigidly enough to keep your flock at a good level of egg production throughout the year, as shown for New Hampshire flocks in the accompanying illustration.

3. *Economy sense in controlling mortality.*

Most flock owners can save a lot of money by practicing a reasonable degree of sanitation in controlling mortality. Keep the birds from contaminating the feed and water, and keep them out of the droppings as much as possible because most diseases are filth borne. Keep sparrows out of the laying pens. Don't track a lot of disease organisms from a pen of sick birds to the feed-mixing room and then carry a sack of contaminated feed to a pen of healthy birds. These are just a few things a lot of flock owners do to spread disease among their flocks.

In the state of Washington, one year there were 10 commercial flocks that had about 16 per cent laying flock mortality and a labor income per bird of $1.56, whereas 10 other commercial flocks had a laying flock mortality of 27 per cent, and the labor income per bird was minus 10 cents per bird.

4. *Electric current cents returns dollars.*

The increased returns per bird through the use of artificial lights is clearly shown in the case of lighted flocks as compared with non-lighted flocks in Michigan, largely because of the higher egg production per bird during October, November, and December.

5. *Horse sense in feeding.*

Horse sense in feeding implies using the best rations available and fed according to a definite schedule. Avoid a full neck molt by keeping up body weight, feeding moistened mash or pellets at noon if necessary. Keep fresh mash before the birds all of the time, but fill the hoppers only two-thirds full so that the birds won't waste feed.

6. *Pounds of feed consumed per dozen eggs produced is the most sensible measure of efficient flock management.*

Since the cost of the feed represents over one-half of the total costs of producing eggs, the pounds of feed consumed per dozen eggs laid by the flock during the year is a pretty good index of the kind of a laying flock you have and how efficiently you managed it.

Low fall egg production, low annual egg production, high mortality, insufficient culling, poor rations, and carelessness in feeding all tend to increase the number of pounds of feed consumed per dozen eggs produced. Pounds of feed consumed per dozen eggs laid has a direct effect on net returns per bird, as shown in the case of Michigan farm flocks in pre-war times when feed and egg prices were lower than in these strenuous times.

Plenty of common sense in laying flock management will return dollars in egg production.

New Winter Legume

Heralded as the greatest "find" since lespedeza, blue lupine is rapidly replacing vetch and Austrian winter peas as a winter legume in the southeast.

Although present strains of blue lupine are adapted only to Florida, Georgia and Alabama, plant breeders are working on new strains that will be more winter resistant, hence usable farther north.

Farmers find the new crop has at least three big advantages:

1. It produces a larger tonnage of green manure than Austrian peas or any of the vetches. It also "grows off" earlier, and can be turned under in time to plant corn, cotton or peanuts in the spring.

2. A lupine crop produces from 1000 to 1500 pounds of seed to the acre ($100 an acre seed yield is not uncommon).

3. It grows on a wider range of soil and under more varied moisture conditions than the other winter legumes. Lupine stands drought well.

The seed-producing ability of the plant is particularly attractive to southeastern farmers, used to paying high prices for Oregon-grown legume seed.

A Houston County (Alabama) farmer sowed a 29-acre field to lupine, and in the fall sold $3250 worth of seed, saved three tons of seed for himself the next spring, and harvested a $2000 peanut crop in the summer.

R. R. McLendon, Early County, Georgia, has increased his peanut yields 200 to 400 pounds an acre through sowing blue lupine. Without adding any more fertilizer, F. P. May, Gadsden County, Florida, boosted his corn yield 40 bushels an acre over a five-year period by using blue lupine as a winter legume.

More than eight and one-half million pounds of blue lupine seed were harvested in 1944. In 1935 the total domestic supply was just two pounds, an experimental packet sent from Europe. *Farm Journal and Farmer's Wife*

Thin Stands of Corn Produce Bigger Ears But Lower Yields Than Thicker Plantings

Condensed from Science for the Farmer

L. L. Huber

THE number of plants per acre may be and often is an important factor in efficient corn production. It may be as important a factor in increasing yields as the use of hyrid seed.

These questions arise:

How many plants per acre will my land support?

Shall I plant 2, 3, or 4 kernels per hill with a 38-by-38-inch spacing?

What difference in yield may I expect if I have 8000 or 12,000 plants per acre?

Obviously, specific recommendations can not be made unless something is known about the general productivity level of the soil. For example, 12,000 plants per acre on 50-bushel land would likely prove disappointing. The resulting ears would be too small. On the other hand, 8000 plants per acre on 100-bushel land would constitute an error in the opposite direction. The ears would be too large. Each grower must necessarily determine his optimum rate on the basis of experimental data plus knowledge of his own soil productivity.

Data are available which clearly indicate the variation one may expect due to differences in rate of planting. A test in Pike county in 1943, including 8 strains of corn, showed a yield of 91 bushels of shelled corn from 10,000 plants as compared with 115 bushels from 15,000 plants per acre. This rate is roughly the equivalent of 2 and 3 plants per hill, or a plant every 18 and 12 inches in the row respectively, with 36 inches between rows.

A 10 - entry test in Carbon county, planted at the same rates, yielded 88 and 98 bushels per acre. The same test planted in another location in Carbon county at the rates of 9600 and 14,000 plants per acre yielded 73 and 76 bushels per acre.

On soils of the higher levels of fertility there have been marked differences in yield. Three rates of planting tests in Lancaster county in 1943 and 1944 using only one strain in each test

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showed similar differences. One test in 1943, grown under severe drought conditions, produced yields of 49, 57, and 60 bushels of shelled corn per acre with 2, 3, and 4 plants per hill, 40-by-40-inch spacing, or 7500, 12,000 and 15,000 plants per acre. With adequate rainfall the yields in this test should have approximated 90 bushels per acre. The average yields of two tests in 1944 were 76, 87, and 89 bushels per acre with 2, 3, and 4 plants per hill with 42-by-42-inch spacing or approximately 7000, 10,000 and 14,000 plants per acre. The average weight of ears on these two tests for the 76, 87, and 89 bushel yields was .76, .61, and .44 pounds each.

These results are in line with those obtained by other experiment stations. For example, a 21-year average of yields obtained in Ohio at planting rates of 1, 2, 3, 4, and 5 stalks per hill with 42-by-42-inch spacing showed yields of 40, 51, 63, 67, and 66 bushels of shelled corn per acre. The Ohio data indicated a significant reduction in yield when the number of plants per hill was reduced from 10,000 or 11,000 plants per acre to 7000.

It is obvious that in a state with the tremendous variations in soil productivity as in Pennsylvania, different rates of planting are advisable. The specific rate which will result in highest yields depends upon the local conditions under which corn is grown. It is equally obvious that the 15 to 20 per cent increase in yields obtained by planting corn hybrids instead of open pollinated varieties may be and probably often is cancelled by stands poorly adapted to soil productivity levels. It is apparent also that large ears resulting from too thin stands are not usually associated with highest yields per acre. An ear weighing about one-half pound seems to indicate the most efficient use of land. The producer of corn hybrids, therefore, will constantly strive to find the optimum planting rate for his own farm. Just as the use of an adapted corn hybrid is a step in the direction of more efficient corn production, a rate of planting adapted to the soil productivity level of a farm is a step in the same direction.

Mammary Gland Development in Calves

Condensed from Herd Builder

W. W. Swett

Washington State College

SEVERAL years ago Bureau of Dairy Industry began making regular periodic examination of glandular formations in udders of calves, beginning soon after birth of the calf and continuing to 18 months of age, to determine the significance of mammary gland development in calves as an indication of future producing capacity. It soon became apparent that the external appearance of the udder might be very deceptive. Some udders that seemed to be well developed had little glandular tissue while others that appeared small had well-formed glandular tissue. The disposition of fat in the udder seems to be the chief factor that created the deceptive apearance. After studying the udder development of some 200 calves during the first 18 months of growth, the Bureau developed an average or standard for each of two breeds, which provides a basis for evaluating the mammary development of any calf at any age. At each examination the glandular formations are studied by palpation and a numerical grade is assigned, depending on the intent to which the glandular development is ahead of or behind the breed standard. Grades range from 1 for the most retarded to 9 for the most advanced development.

A preliminary analysis has recently been made to determine the relationship between the grades assigned at different ages and the milk production records of the same animals. The average mature equivalent production of the cows that had received the upper grades of 7, 8, or 9 when calves, was some 2,500 to 4,000 lbs. greater than that of the ones that receive the below-average grades of 1, 2, and 3. The results indicate that the most significant grades were the ones assigned when the calves were about 4 (3 to 5) months old.

It is noteworthy that these results were obtained from a study of animals in the Bureau's breeding herd at Beltsville, Md., where the continued use of proved sires has raised production to uniform

Reprinted by permission from the Herd Builder, American Scientific Breeding Institute, 134 North La Salle Street, Chicago, Ill., June 25, 1945

and very high levels. A greater degree of variation in grades and in production might be found in herds where a similar breeding program has not been followed. The results are encouraging since they indicate that it may be possible to predict the relative producing capacity of dairy calves at 4 months of age, with a reasonable degree of accuracy. Thus the potentially low producers may be identified and culled at an early age.

The method of examining and grading calves is not difficult and requires very little time. It is difficult to describe but easy to demonstrate. Probably two persons would arrive at slightly different grades if an attempt were made to use as many as nine grades, but after a little practice they should be able to agree on whether a calf deserves a high, medium or a low grade. The method was tried by a group of cow testers in Pennsylvania, on a group of calves selected by the Bureau demonstrator to illustrate different degrees of advancement. Although these men had little previous experience, the grades they gave were in very close agreement with those assigned by the demonstrator. Close agreement has resulted among men with no previous experience who participated in numerous demonstrations at Beltsville.

Speaking of Optimism—

Only a cook with a bluebird complex would expect to leave the cream pitcher on the table for a year, and come back to find its contents palatable. Sounds fantastic, but a California company is now processing table and whipping cream for the armed services which keeps for longer than a year at room temperature, and still retains its orginial qualities of freshness, non-coagulation and flavor.

Prior to processing, a small amount of vegetable stabiliizer, one-fourth of one per cent or less by weight, is added to sweet fresh cream. The mixture is then preheated and sterilized at temperatures varying from 260 to 280 degrees F, then cooled rapidly, passed into sterile holding tanks, and piped to the bottling room as needed.

The entire cycle takes about four minutes. In a standard pasteurization process, a cycle of about 30 minutes is required.

—*Hospital Topics*

What Is Happening to the Water in Your Well?

Condensed from Electricity on the Farm

EVERY now and then we receive an inquiry about a pump that has started to produce "white water" or a well that is failing in its supply. Things are happening to underground water supplies.

In general, farms where water is obtained from wells still have a good and adequate supply. That supply may fluctuate slowly with the rainfall or with the amount of water used, but it is still one of the greatest blessings of the rural areas. Wells that are close to cities or to large industrial plants may not be so fortunate as those farther away.

Well water comes originally from rain or pond water or stream water that seeps down through the soil into the porous underlying layers. These water-bearing layers or strata may be near the surface (shallow wells) or deep down beneath layers of impervious rocks (deep wells). In these deep strata the water may travel for many miles from where the porous layer outcrops near the surface. Water may also occur in seams in porous limestone formations.

In any one location, the depth below the surface at which free water is found in the soil, or the depth at which water would stand in a well not being pumped is the depth to the "water table." Just as soon as one starts pumping water out of a well, the water level in the well drops. This "draw down" of the water level will continue until the rate of flow in the well equals the rate of pumping it out. Again, if there is a shortage of rainfall, or the rainfall runs off the surface instead of soaking in, or if great quantities of water are pumped from many wells in the porous strata, then the ground water table will be lowered and your well may fail.

During the past decade water tables in some localities have been dropping alarmingly. The receding level has made it necessary to go deeper and deeper for water and to use more power in pumping it to the surface. This is making a tough problem, particularly for some cities which have depended upon wells for their water supply.

The reason for the lowering water tables are understandable. One which involves the country generally is the removal of surface vegetation and forest cover

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with its accompanying increase in surface run-off. Soil conservation practices will save some of this rain water and give it time to seep into the soil. A year or more with subnormal rainfall may also affect the water table. Of more immediate concern, however, is the greatly increased pumping which has been taking place. Cities are using much more water. For example the water pumped from wells by the city of Louisville has increased from 37 million gallons per day in 1937 to 62 million gallons in 1943. Much of the extra water being used in cities is going into war plants, chemical plants and as cooling water in air conditioning. It takes about 18,000 gallons of water to produce a ton of steel. Paper manufacturers, synthetic rubber, airplane factories, all use large quantities of water. Air conditioning has made one of the greatest recent demands. It calls for cool water. As a consequence many additional wells have been drilled in cities and towns. The problem of supply has become serious enough in some locations that cooling water after serving its purpose of cooling is pumped back through other wells into the ground to replenish the supply or is impounded on porous settling beds to seep back into the ground.

The Division of Ground Water of the United States Geological Survey has been making studies of ground water supplies for many years. Recently it has been called upon to come to the aid of numerous war plants where water supply was the limiting factor. State geologists and water supply boards have also been active in locating and attempting to conserve the supplies. The states of New Jersey and New York have passed special laws regulating the use of underground waters. In the irrigated areas of the western states the ownership and use of both underground and surface waters have been governed by water laws for many years, and much of the litigation in those states has been over the use of water.

Aside from the matter of general welfare, this lowering of water tables may have a very direct and specific interest to the farmer whose well is being affected. There are several things that can be done about it.

If water is pumped from a shallow well, either a driven well or a cased, drilled well, and the pump is sucking air or not delivering the water it should, the first thing to be done is to measure the depth of the water in the well after a period of six hours or more when there has been no pumping. The measuring may be done with a stick or a weight on a string or an electrical measuring

device. The electric device consists of two waterproof insulated wires with bare ends, insulated from each other and the casing but which will be shorted when they touch the water. At the top you place a hot shot battery and a door bell or buzzer in the circuit. When the bare wires reach the water, the bell will ring. If the water is 20 feet or less below the pump, but the supply gives out quickly when pumping, the trouble may be a clogged well screen or silted well or a weak water producing stratum.

Driven wells may be pulled for cleaning the screen and pipe or new points driven. Cased wells may have slots punched in the casing with a special tool and any sand in the well can be baled out with a driller's bailing bucket. Surging of such wells by rapid bailing and churning of the bailing bucket may also help to clear the screen and improve the inflow.

If one shallow well does not give an adequate quantity of water, a number of well points may be driven. They should be 10 feet or more apart and each well should be driven to the same depth and be equi-distant from the pump. Each well should have the same size pipe and the same fittings in the pipe in order to keep the suction as nearly the same in each well as possible.

A shallow well pump can be depended upon to lift water only about 25 feet (static lift plus pipe friction) at sea level and less at higher altitudes. As the pump gets older, or if leaks develop, it may not lift that much. If the water table is down around 22 feet, that is about the greatest lift one can count on unless there is an exceptionally good flow in the water bearing stratum, as normally you might expect a draw down of several feet in the well when pumping. When the maximum suction lift of the shallow well pump is reached, it is necessary to use a different type of pump.

Should a deep well pump start pumping air or fail to deliver its usual quantity of water, the trouble may also be due to a failing water table. Measure the water level to be sure. If the water in the well has dropped below the pump cylinder or suction pipe, the pump will have to be pulled and the cylinder lowered or a section of suction pipe added below it. A deep well cylinder in good condition will raise water by suction a distance of about 25 feet the same as a shallow well cylinder. It is much better, however, to have the cylinder low enough to be submerged in the water even though a short suction pipe is placed below the cylinder. If the well is

not deep enough to lower the cylinder, it may be necessary to drill deeper or to locate a new well. This will depend on the underlying rock formations about which an experienced well driller should have information.

Before blaming the failure of a pump on a shortage of ground water, we have said you should measure the depth of the water. You should also check for leaks all joints in your suction pipe as well as foot valves, pump valves, gaskets, and packing glands. Pump leathers may be worn and need replacing. In other words, do not get alarmed about your supply until you have run down the mechanical and neglect possibilities that could cause the trouble. Pumps do need attention occasionally.

When a clean well with clean screens does not produce enough water to keep your pump running automatically, there are several things that can be done. If you are using a large pressure tank, of say 100 to 500 gallons capacity, you can substitute a smaller tank. That will cause the pump to start and stop more frequently and to pump less water each time it runs. That would give the well a chance to fill up. Something of the same result can be accomplished by having your pump man reset your pressure switch to cut on and off at 30 or 40 pounds instead of 20 and 40. Another possible solution would be to change pulley sizes on motor or pump or both so as to slow down the rate of pumping. This can only be done with reciprocating and rotary pumps. Centrifugal and turbine pumps, including most of the jet pumps, should run at their rated speed, but the delivery can be reduced to the capacity of the well by throttling with a valve placed in the discharge line.

Jet Pump to Rescue

The jet pump is a very desirable unit in helping one out of difficulties with receding water tables. It will lift water from beyond the limit of suction without placing any moving parts in the well. It can be substituted for a shallow well pump without having to be placed over or near the well. It is an efficient pump at lifts up to 60 feet or more, and can be used for lifts in excess of 100 feet.

The newest development in jet pumps—the convertible pump—is the happiest solution of the pumping problem where there is danger of a receding water table.

How a Sheep Herder Ranges His Sheep

Condensed from Sheep Breeder

Wilbur D. Draper
Deer Lodge, Montana

VERY few people think of herding sheep as a vocation, but 25 years ago I decided to give it a turn and, when I got too old to do it right any more or give it the proper attention that it deserved, I had to give it up as far as working for other people was concerned. However, I do want to say that it is about the most interesting work one can do. There are many little things one doesn't know about at the start, and those are the things I wish to tell about, as I learned them. When I started with sheep there was not much information or literature available to help a fellow, as I looked everywhere for something that would help me with the sheep work, but there was nothing—so I started to experiment and learned quite a lot as I went along.

For instance, when the sheep are on the green grass for more than a week at the outside, the bed ground will become too dirty. There are many advantages in moving the sheep once or twice a week in the summertime, as you preserve the range, which is very important. Also the sheep will be in better health, you will have more contented flocks, better sheep, better lambs, no worms and less bother from the flies, and an earlier start in the morning. One will be herding about a thousand ewes and their lambs during the summer—only on the mountain ranges are the bunches smaller, and there are sheepmen who run them larger there. Remaining a long time in one place causes the sheep to cut up the range too much, going to and from camp, and the camp and bed ground will be cut down to the dust, so that all that will grow there for several years will be weeds and this will spoil much of the range as time goes by. A person who figures on ranging a long time in any one part of the country should do all he can to preserve range conditions as this will always pay better dividends than trying to get by with little work and more fishing trips.

Montana herders used to have two horses with an outfit and

Reprinted by permission from the Sheep Breeder, Chicago, Illinois, July, 1945

could use either of them to ride or drive. That took care of the work I do with a trailer house and a truck. I move camp twice a week and am careful to bury all tin cans as well as bury any sheep that dies on the range. All these things help to keep the green flies and house flies down to a minimum. When we work on the range, the range is what we make it and I rather like to keep it looking very beautiful.

Some herders think it is lonely on the range. Well, you generally find those fellows are the ones who spend a lot of time figuring how they can get by without doing so much. These men will never be good herders. In all the years I herded I never had to depend on an alarm clock to awaken me and, when the sheep were ready to go, I had the horse saddled, fed and the housework all slicked up. I was ready to look the sheep over as soon as they started getting up to go, and I looked them over for possible maggots, sore eyes, hungry lambs, dirty sheep, distressed sheep, etc. One on his toes all the time will discover many things in the sheep from time to time and will welcome the opportunity to remedy these conditions which will occupy some otherwise idle hours and break the monotony.

In selecting a camp, try to get away from places where there are old roads or trails. Such places may lose lambs for you on moonlight nights. Lambs like to romp in the moonlight; they will sometimes run too far away if they have a trail to run on. Sometimes they will become scattered out at the far end and lay down until they are lost, and the coyotes are wise to these habits and are always around to make matters worse; so it is a good idea to avoid such camp sights. A good place for a camp will have a shallow bank where the lambs can romp until they get tired and then, like a child, they are ready for bed. There should be a hill for protection from storms. By moving camp often, the coyotes do not get so bold as to invade the camps. If you are having trouble of this sort, make a circle after the sheep have bedded down, about a hundred feet from the outside of the flock; use your knife and cut off bunch grass under the dirt and rough it up a little with the bare hands. The fresh scent will keep old coyotes away. You can hang a lantern out on the far side too, but the grass trick in about four or five places will be the best. Leave the horse on the picket sometimes, and walk with the sheep. This scent will help to keep coyotes away from the range too; but there are some feeding whelps that get very brave, and one has to shoot

or trap them. By watching and planning it can be done. Sometimes they can be followed and dug out. By using glasses from a hill that overlooks much of the range, they can be followed right to the den, and the coat over the hole will keep them there until you can get the proper tools to take them out.

If you have a sheep that has maggots, use cresote dip, full power and, after the worms are removed, wash well with water and pour on some cream separator oil and a little pine tar to keep the flies off till it is healed completely. A wether lamb will show distress by being nervous and stamp around a lot and want to stay in the shade. If the maggots are on the tail, the sheep will be trying to bite the tail and the tail will, after awhile, be black around the end and up into the wool some. If one sees these signs immediate attention should be given.

Sometimes you will see some sheep are not doing so well. They may be old, maybe not. The mouth and teeth should be checked. Sometimes you will find a sheep with one tooth only. Remove the tooth with a pair of pliers. There may be spear grass in the mouth some place. Look under the upper lip and along the jaw teeth. Or, it may be stomach trouble; but the mouth is the place I have found the most trouble. If you have an old ewe that isn't doing so well and she has a lamb that she hasn't time to stand for while it suckles, and the lamb has to take his meals on the run from behind, be sure the ewe and lambs are mates, and send them both to the ranch for better care. One has so many things to do on the range that there is not time for one man to do it all the way it should be done, so it is much better to cut some of the work where it can be done safely.

Some people from the large cities as Chicago and New York have come out to the western ranges and taken on a ranch the size of two hundred sheep and tried to run a thousand on it. Well, in cases where you find a crop of grain for borders on such places, it will be necessary to fence—and brother, you want a fence! A sheep fence should be all woven wire 4 foot high, stays six inches apart, and a 5-point galvanized hog barb of the glidden 2½ X. Use one of these on the ground and the other 10 inches or a foot above the netting. It is a very good plan to make the top wire an electric fence, and, if you use wooden posts, it is a good plan to ground the netting with a 12-inch steel pin about four times to the mile. This will protect the sheep against lightning and will also make the

electric fence more effective. With lynx cats and such that climb the post, they will always use the woven wire as a handy ladder and the top wire will touch them and the cat will fall off on the outside where it should be.

Sheep should not be turned loose in these pastures without a herder. A camp should be set in the middle of the pasture on as high a hill as can be found, and the herder uses a tepee and sleeps wherever the sheep bed down. He can walk to camp for breakfast whenever the sheep are safely away to graze. They should be discouraged from bedding more than one night in the same place. The salt tubs should be by the water source, or at the main camp. They will get the habit of coming to the main camp for salt when they want it. A good pasture should not be used until it becomes necessary, and then only as long as it is really necessary, and it should not be over-grazed as it takes a pasture some time to come back in such cases.

The herder in a pasture will keep the fence in good repair, watch the sheep for troubles mentioned previously, and keep them off their backs and "on the old feet" so to speak. The pasture should be looked over for poison weeds too, before the sheep are turned in. Some people think this is a waste of time, but some of these same folks are surprised at what one can dig from some of these places.

The weed question will be described later in another installment. If the reader thinks I am writing something to help in the raising of sheep, I would appreciate any comments on the subject. I am not selling these articles; I am writing them in the hope they will be accepted the way I mean them to be—as a help to those in the dark about these things.

A Layout for Laborsaving

Condensed from Successful Farming

Carlton Stoddard

WILLIAM RENK and his three sons have remodeled their barns around their tractors—and by so doing have furnished farmers and "efficiency experts" alike with a good deal to talk about. For the Renk livestock system completes the circle of growing the crop, harvesting it, feeding it, and returning it to the land as manure with surprisingly few man hours spent on the job.

Kindly, keen-eyed William F. Renk of Sun Prairie, Wisconsin, is a hybrid seed grower, stockman, and premier Shropshire breeder of the nation. His sons, Walter, Wilbur, and Robert, are of the same mold; all four concentrate on outsmarting the pitchfork and scoop shovel.

Wisconsin was rocked back on its heels this year when the Renk farms tallied over a million pounds of steers, hogs, and sheep sold on the hoof—12 months' output from 850 acres. That plus 25,000 bushels of hybrid seed corn, 10,000 bushels of Vicland oats, and a carload of sheared wool added up to an 86-car trainload of produce.

There are some angles to Renks' tractorized feeding plants that have made veteran feeders stop and look twice to see what's going on.

Each of five such farm plants, built so a tractor can be driven inside for both feed and manure handling, has been reduced to a one-man setup. One man manages 350 hogs, 100 steers, and 45 sheep. And he does it in eight hours of light chores a day from about December to April. From then until snow flies he is free for field work while animals tend themselves on pasture and help themselves to every fourth (male) row of hybrid seed corn left in the stalk.

"Mechanized barn" may suggest a farm factory rumbling with driveshafts, pulleys, and conveyor belts. On the contrary, there is not even an elevator to get out of whack.

The Renk principle is simply this: arrange your barn on two floors, wtih a ramp leading up to the second story so a tractor and wagon can be driven into a large, feed-storage room. That elevates your feed high enough

Reprinted by permission from Successful Farming, Des Moines, Iowa, July, 1945

so it can be distributed to the lower floor by gravity. (With chopped and baled hay foreshadowing smaller haymows, thousands of existing haymow driveways could be remodeled and enlarged to provide such a feed storage and grinding room.)

Hay slides out easily thru a chute to the cattle-yard feed rack. Ground feed drops thru a trap door to self-feeders for hogs quartered on the lower floor of the former dairy barn. The most unusual feature is Walter Renk's postwar plan for a swinging-boom carrier track from silo to cattle feed bunks. They will be arranged in a half-circle or arc matching that of the boom.

All winter I waited for the opportune moment to get a picture story of the final step in the Renk cycle. One balmy spring day when the fields were drying fast and the manure spreaders were ready to roll, I got the high sign from Wilbur over the long-distance phone. The show staged that day was a demonstration of manure management which strikes a new chord for future soil building.

No wonder there is intense interest in the tractor manure loader. A steel plate bolted to the underside of Renk's power manure fork transforms it into a giant scoop shovel that had a third of the 100 x 100 concrete feed yard scraped clean before I could get my camera set up.

Then it nosed inside the concrete-walled cattle shed thru 11-foot-high doors, and in three bites had a spreader full. Not a pitchfork nor a shovel in sight, yet before the slick-haired, lazy Herefords woke up to what was happening, the shed "floor" had dropped three feet. The winter's accumulation of manure that had elevated them nearly to the ceiling (and kept them warm underfoot) was out on the field and plowed under before the ammonia could evaporate or leach away.

Ammonia, of course, is NH_3, nitrogen and hydrogen. Loss of it thru leaching, when a manure pile lies exposed to the weather, bothers the conscience of any good husbandman. Not so well known is the fact that ammonia evaporates when manure lies all winter on frozen ground. One-third or more of the nitrogen often escapes into thin air, say University of Wisconsin soil chemists. The fertility-wise Renks stop ammonia loss on both counts by storing up manure in a savings bank—the cattle shed.

The shed and concrete feeding floor combined serve the same as a manure pit, with every corner accessible to the tractor loader. Nothing can get away. Occasional scraping with the tractor cleans

the yard. Otherwise, manure chores are forgotten until spring!

Actually, the Renk philosophy is to manufacture manure with highly potent fertility, rather than consider it merely a by-product. To illustrate: they grind up 190 tons of waste corncobs for bedding. Not only are the ground cobs an excellent absorbent, but manure acids hasten their decomposition and increase their fertility value.

The real story in Renks' mechanized feeding system *is* fertility. How they manage to keep up the land and take *two tons* of meat and grain off every acre every year . . . well . . . let Walter give you the answer:

"We made a study of manure and learned that half-strength stuff couldn't do the job.

"We conserve the manure carefully, without a lot of shoveling over. That's the first step. Then comes commercial fertilizer to balance the nitrogen with phosphorus, potash, and lime. Our ground is all limed for legumes. Plus that, we give the land a real shot in the arm with 8-8-8 fertilizer applied by a plow-sole attachment, 300 to 500 pounds per acre. On top of that, 125 pounds per acre of 3-12-12 as a planter side dressing. Grain gets a good feed of 0-12-10 when it is drilled.

"Results in bigger yields are obvious, but we've discovered something else. Crops are higher in protein and mineral content. It shows up noticeably in feeding. The corn puts on a faster finish. There's so much lime and mineral in our alfalfa and grass silage that they satisfy all the ration mineral requirements."

Can it be that food grown on land supercharged with manure and minerals might stimulate human health as well? Wm. F. Renk and his three boys may have started something when they designed the mechanized barn to manufacture fertility as well as food.

Dangers of the Compost Pile

Condensed from The Rural New-Yorker

M. B. Cummings

THE garden compost pile is sometimes a menance to healthy plants. It may harbor many insects which pass the Winter in garbage, refuse and the compost, and it may also carry over spores of disease on affected leaves, stems, fruits, seeds, or tubers.

Hollyhock rust is an example of these pests that live over on the old leaves and sometimes on the new ones that form late in the Fall. They may pass the Winter in the compost pile or near it, and be later returned with the product to the garden or to the greenhouse bench.

Several mildews also winter on leaves and stalks and reappear because the disease is tided over on refuse plant parts. The mildew of roses, the very common mildew on garden phlox of several species, the mildew of sweet peas and garden peas, pass the Winter in the minute black spots on leaves known as fruiting bodies in which spores are formed during the Winter season and are released the following Spring, when the product finds its way to garden or greenhouse soil. Many rusts also live over in trash and garbage. The common rust of snapdragons and carnations is an example of this sort of trouble which should not be allowed to accumulate, and thus become devastating in succeeding years.

A considerable number of injurious insects may also live over the Winter in the stalks, stems, or on the leaves of old garden plants. A few illustrations will indicate the danger of allowing infested plant products to find their way to the compost, and then again later to the garden. Cabbage aphids over-winter as eggs deposited on old cabbage stalks or other host plants. In the Spring the young aphids hatch and begin feeding within two or three weeks, reaching maturity in a short time, after which they give birth without mating to living young which develop as winged or wingless females.

Several other common pests that may go through the Winter in the compost pile include cutworms, which were very troublesome in 1945 and did an immense amount of damage in flower and vegetable gardens in New England. Their eggs are usually laid on garden plants, grasses or weeds. In the Spring the eggs hatch and develop into

Reprinted by permission from The Rural New-Yorker, New York City, Sept. 15, 1945

the larva or worm stage of the cutworm, which is common to gardeners as a pest that cuts the plant off close to the ground. Potato aphids over-winter in the egg stage on rose plants. In the early Spring they hatch into young aphids similar in form to the adults. The winged forms fly from the host plant to other crops, where they in turn feed and reproduce.

The common stalk borer, found on many plants as an active, slender brown worm within the stems of weeds and cultivated plants, lays its eggs on various weeds and grasses, and it is in this stage that the insect passes the Winter. Such infested material should not be composted. Pupation takes place within the stalk of the host plant. The pupa remains in the plant until the adult emerges weeks later. The European corn borer passes the Winter as a full-grown worm or caterpillar in the stems of plants upon which it has fed. Many flowering plants and some vegetable plants as well are hosts for the European corn borer. Deep Fall plowing controls the corn borer, but it winters well when placed in the compost pile in stalks or stubble. The squash bug over-winters in the adult stage on trash and rubbish in the field as well as in cracks and crevices around buildings. The bean leaf beetle lives over in the adult stage by hibernating in trash or clumps of grass which is dry. This insect emerges during the early Spring and feeds for a time on beans and other plants. White grubs, at least one species of them, may live over in the manure or compost pile, and be distributed to the garden in the Spring with the compost product or manure or both, if they are mixed. These citations are only a few of the many that could be given to show how the compost may be a menace to good gardening.

What has been said serves to emphasize the importance of sanitation at harvesting time or when any plants are matured and disposed of, for unless care is taken, the pests may again find their way into the garden, perhaps in increased numbers, and constitute a threat to successful production.

While it is true that the compost pile is often commendable and desirable, still it should be recognized that any plants or plant products that are known to be infested with an insect or affected by a disease should be eliminated and given special destructive disposal to break their life cycle, thus preventing the recurrence in a succeeding year. It will pay to watch for all such things and thus avoid contaminating the compost pile with them.

Blueprints for a Better County

Condensed from Southern Agriculturist

Harold Severson

THE biggest shock in the history of Putnam County, Tennessee, came the afternoon of July 10, 1944. That was the day people discovered what was wrong with their county. Up at the courthouse in Cookeville, scores of farmers, county officials and townspeople looked at one another in shocked astonishment. A few had suspected the truth; to the majority it came as a complete and jarring surprise.

The mass meeting called by government agricultural workers let many unpleasant facts out of the bag. They burst with the impact of a mortar shell. Putnam County was poor—not only in farm income but in soil fertility. Over half its topsoil had washed away. The remainder was poorly farmed in many cases. As a result, Putnam County's farm income per farm person had dwindled to less than $70 each year. So poor was the county that it ranked far down among the 95 counties—eighth from the bottom.

The speakers knew their facts. For months they had patiently collected data and statistics from government surveys and reports. Working on their own time and under their own momentum, they had carefully planned a four-point program. The mass gathering held immediately after the county court meeting that July afternoon gave these government workers a chance to present their story to the people most interested in it. Nine large charts illustrated the points to the intent audience. Census figures were quoted to show the close relationship between soil erosion and rural poverty. It all added up to a very drab and depressing picture, for rural Putnam County was financially and physically ill.

Many of the facts were ugly, for they indicated a downward trend. Some stood out from the others. One was the fact that only a small percentage of the rural students ever completed their high school education. Another was that farmers were buying feed and seed grown outside the county at a cost of more than a third of a million dollars annually instead of raising their own

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feed and seed. And that a large percentage of the farm homes lacked running water, electric lights, kitchen sinks, closet space, screened doors and windows, and sanitary toilets. A discouraging misuse of land was revealed.

Worried faces and anxious questions testified the facts had struck home. They were too startling to be ignored or tabled for future consideration. What was the next step?

About 125 persons were present at the meeting. Five questions were asked of them:

1. Are you satisfied with present farm and home conditions?

2. Is it possible to improve these conditions?

3. Do you believe the changes would be worth all they cost—even several times over?

4. Do you think the proper time for making the changes is right now?

5. Will you ignore all obstacles to make the program a success?

Favorable answers were received to all questions except the first one. Machinery for setting up a permanent program was promptly set into motion. The first move was to select a committee of 46 farm leaders—both men and women—to develop a master agricultural program. Fortunately, the information collected by the county agricultural workers could be used in formulating a definite campaign for improving the county's physical and financial condition.

Casting around for a "catchy" name, the committee finally decided to call it the "Putnam Prosperity Plan." Instantly it began to attract attention in unexpected quarters. People in the most remote communities began to hear of it and ask questions. Business leaders in Cookeville, the county seat, and in the small villages pledged their support. A fund for advertising the program in the *Putnam County Herald* through full page advertisements was heavily oversubscribed. County officials and members of the agricultural department at Tennessee Polytechnic Institute at Cookeville contributed material assistance.

Essentially, however, it was the determination and unflagging effort of Putnam County's agricultural workers that made the program a reality. Their co-operation and keen interest have been outstanding.

Every group working with farmers is represented on that team. Sparked by County Agent J. Huse Martin, the committee has representatives of the Extension Service, Soil Conservation Service, Farm Security Administration, Vocational Home Economics, U. S. Forest Service, AAA, Federal Land Bank, Voca-

tional Agriculture, Tennessee Polytechnic Institute, Feed and Seed Loan, and Production Credit Association.

Remarkable in many ways, the program grew out of a series of night meetings. The workers sacrificed their own time in order to collect information. Nobody in Washington, Nashville or Knoxville assigned them to this job. It was entirely voluntary. Lights in their offices burned long after midnight as they bent over charts and government reports. Out of these sessions came the four-point drive to rehabilitate soil and people.

The opening salvo of the battle to defeat rural poverty was fired December 28, 1944. An advertisement in Editor Beecher Gentry's *Putnam County Herald* listed these objectives:

1. Sound land use and soil conservation.
2. Improved farm homes and family life.
3. Proper farm management.
4. Better marketing of farm goods.

It is an ambitious program. The idea is to build a sound agricultural future while producing under wartime conditions. Putnam County is a region rich in beauty but poor in farming resources. Steep slopes are planted to corn, with the result that the best of the soil is washed away. Many of the farmers operate on a corn-hog basis although corn yields average only 17 bushels to the acre. Low yields make it necessary to pay about $240,000 each year for feed in order to compete with Corn Belt hog growers. For that reason, agricultural agencies are working out pasture farming programs. In Putnam County grazing is possible nearly the entire year, so emphasis is being placed on increased production of milk, sheep and beef, through small grain and pasture.

Front page articles in the Cookeville newspaper are supported by the full page advertisements scheduled to appear each week. Prepared by experts, the articles call attention to various phases of the Putnam Prosperity Plan. These include farm marketing, conservation surveys, improved pastures and grazing crops, poultry production, dairying, contour cultivation, crop rotations, farm credit, and home management.

The program is supported by Putnam County residents in all walks of life.

The program is also being publicized at community meetings. A typical one was held in the Thomas community on a cool, rainy night in May.

Mr. Lehning did most of the lecturing. He had a soil survey

map of the Thomas community with him and pointed out the different classes of land. His audience bent forward and watched intently when he pointed out the farms of different members of the group. Over and over again he emphasized the need for more pasturage and less corn.

Pasture Farming Urged

"You never see much corn land even in the best Tennessee counties," he remarked. "Farmers know better. They let livestock do their farming. We can do the same here."

County Agent Martin answered some of the questions hurled at Mr. Lehning. When the meeting was over, definite progress had been made toward educating farmers to the benefits of pasture farming.

The Putnam Prosperity Plan was designed to succeed despite changes in agency personnel. Ten years from now, the county should present a marked improvement. The gospel of better farming through grassland is spreading rapidly. In a decade or two, the sight of steep slopes plowed to corn will be as rare as a Model T automobile. And in the wake of balanced farming systems will come the prosperity which the plan offers to intelligent farmers anxious to better their lot and conditions in the county.

At the same time, the "Putnam Prosperity Plan" is a challenge and an inspiration to other counties suffering from the same troubles that so long afflicted this one.

"2-4-D" Gets Trial

The new weed killer, 2-4-dichlorophenoxyacetic acid (popularly called "2-4-D") will be tried out this year in Vermont pastures on hardtack and shrubby cinquefoil. Previous tests have proved it to be deadly to bindweed, dandelion, poison ivy, chickweed, ragweed, and plantain.

Unlike other weed killers, 2-4-D is one of the plant hormones which regulate plant growth. Absorbed by the weed leaves, it spreads through the plant, causing distorted growth and destroying the plant's chlorophyll. Advantages are it can be applied without killing grasses, and does not burn or explode, corrode sprayers, or reduce soil productivity.

Packaged Fuel

Condensed from Capper's Farmer

IMAGINE carrying a 3- or 4-week supply of fuel in one hand! That leaves the other free for toting a bale of binder twine, lugging a bag of groceries, or for unlocking the car. Once that packaged fuel is in the car trunk, springs don't sag, tires don't flatten.

That's the concentrated convenience which modern science, the petroleum industry and appliance manufacturers are providing for thousands of farm families. They expect to extend it to many thousands more as soon as war restrictions and war uses are relieved.

The fuel is packaged, literally, whether it comes in little or big containers. The smallest, 1-hand size, weighs less than a bushel of good barley, 3 pecks of shelled corn, about the same as a 5-gallon can of kerosene and the dealer won't stick a potato on the spout before you start home.

There are larger drums or cylinders, including a popular 100-pound package, and the king-size supply which rolls on rubber, right up to the back door in big tank trucks. The driver refills your storage every month or so, reads your meter, collects or sends you a bill. It's all quite townish, except there are no gas mains with connections out in front. Nobody needs to split kindling, or worry about whether the woodpile will be wet before morning. The farmer washes sleep out of his eyes in warm water and heads for the barn with nary a look at the cookstove. Fact is his wife can have oatmeal cooking, bacon sizzling and eggs popping before he gets his shoes tied. He can even eat breakfast before starting the chores unless he's a stickler for tradition.

Folks began calling this fuel bottled gas when early deliveries were made in metal cylinders that looked like long, slender bottles. In some places they call it tank gas because tanks were used for storage and deliveries. Southward it is referred to as butane and northward as propane, which is a more specific designation. Sometimes a mixture of the two is used. The industry calls it liquefied petroleum gas, or simply LP gas, which is more accurate but not particularly handy. All the big producers and many wholesale distributors have their own brand names.

Reprinted by permission from Capper's Farmer, Topeka, Kansas, Sept., 1945

Both butane and propane are "old stuff" known to chemists ever since they began taking crude oil apart. Years back these gases were excess baggage of the refining industry and the natural gasoline plants. They were too light or too heavy or too volatile for any uses or equipment then available, and so were discarded. That waste rankled conservationists. Chemists finally learned how to extract and liquefy the gases in the laboratory. Then, in collaboration with engineers, they developed commercial and quantity methods of producing, packaging and distribution.

Growth of the liquefied petroleum gas business has been phenomenal. The industry sees great possibilities for further expansion, much of which will be to farm customers. In 1922 the U. S. Bureau of Mines reports 223,000 gallons were marketed. Twenty years later the total was 585,440,000 gallons. Next year sales were 675,233,000 gallons and domestic users took more than half. Industrial use in war production popped the gallonage to 785,000,000 for 1944. None of these figures includes sales of the gases destined for synthetic rubber or aviation gasoline.

What can farm families expect from this packaged fuel? First boom will be to the housewife for cooking, water heating and refrigeration. Then it will be used for heating homes—the entire house in some regions, but mostly for space heating of single or several rooms—and to some extent in drying fruits and vegetables. Farmstead uses will include brooder heating, pasteurizing, sterilizing milk utensils or other equipment where hot water or hot steam can be applied, for warming stock tanks and water fountains. Some farmers were converting their tractors to burn the fuel before the war. It also has possibilities in orchard heating and in killing weeds, as a substitute for cultivation and as a method of controlling noxious infestations where chemical treatments are not practical or are more expensive.

At Michigan State College B. H. Grigsby and K. C. Barrons are experimenting with propane as a means of killing truck crop weeds. In preliminary trials last year results were encouraging. Further tests are under way this summer. At least two manufacturers have built experimental models of tractor-mounted flame cultivators. The hand work required in weeding vegetable crops is a big profit taker.

Prospects also are favorable for using flame cultivation as a step in mechanization of cotton production. At the Delta Branch, Mississippi Experiment Station,

Diesel fuel flame has been used successfully for killing row crop weeds and blocking cotton. Other tests are under way with LP gas in cotton and rice growing. Butane has been used in California, fuel oil in Oregon.

The gases used for farm fuel have different properties altho they serve the same purposes. Propane is liquefied at high pressure and flows freely at temperatures as low as 44 degrees below zero. It is accordingly adapted to colder climates. Butane is liquefied under lower pressure, does not flow freely below freezing temperatures, and so is more popular in the south. However, there are many installations in middle sections of the country where storage, fittings and piping can be buried below the frost line. In sections where only short periods of cold weather occur, mixtures are used.

Propane usually is delivered in steel cylinders, two of which are installed outside the home. When one is exhausted, the other is turned on manually or automatically.

Butane commonly is delivered by tank truck into storage on the premises. Propane may be similarly delivered into a large single permanent tank or into smaller twin tanks installed near the kitchen. The smaller tanks range upward from the drums containing 20 pounds, which are adapted to "cash-and carry" service and are stocked by local hardware or other stores. Large sizes may be replaced or replenished by dealer delivery service.

Cost of the service will vary primarily with transportation from production plant to the user's premises and the quantity of gas he consumes.

Appliance manufacturers are ready with ranges, refrigerators, water heaters, furnaces and space heaters, sterilizers, brooders, and other equipment. Producers have the gas. Preliminary plans for developing additional bulk storage and dealer coverage are under way. Extension of modern gas service to hundreds of thousands of farm homes awaits only conversion after the war.

Jersey Buff Turkeys

Condensed from New Jersey Agriculture

William C. Thompson

Rutgers University

THE development of the new Jersey Buff, medium-sized, quick-growing, broad-breasted turkey, is in its sixth year. Approximately 450 poults of this new breed of turkeys are being reared at the Turkey Research Farm at Millville, New Jersey, this season.

Further infusion of California small-bodied, broad-breasted stock was introduced during the past year. This 1945 crop of poults is showing a marked improvement in this important broad-breasted quality.

Several important decisions have been made with respect to this turkey. First, it is to be called "The Jersey Buff," second, standard weights of 20 pounds for young toms and 12 pounds for young hens are being tentatively established, and third, prime meat quality for butchering at Thanksgiving time is being set at 26 weeks of age.

If these aims are attained, it will mean that turkey growers in New Jersey will ultimately be provided with a type of turkey which may be hatched during May and June, and reared for prime slaughtering quality at the Thanksgiving and Christmas markets. It will be a quick-growing, broad-breasted, vigorous type of bird adapted to the needs of New Jersey turkey growers.

It will fit in particularly well with a turkey growing program in which prime quality turkeys are to be sold retail at the door, freshly killed, dressed and drawn. As the war emergency conditions wane more and more people will desire to drive out into the countryside to select their own holiday turkey, and to have it prepared perfectly fresh and in highest possible quality.

In the Fall of 1944, the Department of Poultry Husbandry found that turkey broilers in this new Jersey Buff variety were a high quality addition to the list of potential meat foods which might be raised on New Jersey farms. Because of the quick-growing and full-meated character of the Jersey Buff, it was found possible to produce a well-fleshed, 6-pound turkey broiler at approximately 13 weeks of age.

Reprinted from New Jersey Agriculture, New Brunswick, N. J., July-August, 1945

This Jersey broiler will definitely interest particular housewives looking for something new and something especially delectable during late Summer and early Fall when high quality fresh meat is not too easy to procure. One trial of Jersey Buff broilers sells the idea to consumers.

From the standpoint of the producer, the turkey broiler might furnish a means of economically reducing the numbers of young turkeys on range, so that those remaining will have more desirable conditions under which to be carried toward maturity.

In some instances it is possible that very early hatched Jersey Buff poults, such as in January, February, or early March, might be turned into broilers in May, so that the equipment would then become available for normal season brooding and rearing.

As during the past two seasons, a limited number of hatching eggs and day-old poults may be available to New Jersey turkey growers in the Spring of 1946. Obviously, the needs of the research projects concerned with this new breed must be satisfied before surplus eggs and poults are declared available for the public.

Value of Corn Silage

With clover hay valued at $25 a ton and corn at $1.00 a bushel, corn silage was found to be worth between $12 and $13 a ton for wintering yearling cattle at the University of Illinois agricultural experiment station, reports W. E. Carroll, head of the animal husbandry department.

The silage-fed cattle received 33 pounds of silage and 4 pounds of clover hay a day and gained on the average 1.09 pounds a head daily during the 126-day period. A ration of 14.15 pounds of clover hay and 4.44 pounds of shelled corn was not quite equal to the 33 pounds of silage and 4 pounds of hay, as the hay-fed cattle gained only 0.94 pound a head daily. The cattle were choice and weighed 680 pounds last fall.

—*Shorthorn World*

Legumes Harness Bacteria

Condensed from Soil Conservation

John P. Jones

Soil Conservation Service

Good farmers use vegetation for the threefold purpose of conserving soil and moisture, and of improving soil. Legumes work well with other vegetation, and we are constantly seeking new and improved varieties, because of their capacity to collect nitrogen from the air—a peculiarity which makes them invaluable as soil improvers.

Legumes collect nitrogen from the atmosphere by what is known as the symbiotic process. This process gets its name from the Greek word that means living together. Symbiosis involves the living together in more or less intimate union of two dissimilar organisms, and is usually applied to cases where the relationship is beneficial to one or both. The collection of nitrogen from the atmosphere by legumes is commonly called symbiotic nitrogen fixation.

The two organisms involved in nitrogen fixation are the legume and bacteria, scientifically known as Rhizobium, which live in the root cells of the host legume plant.

The nodule bacteria invade the roots of leguminous plants through the root hairs and set up housekeeping in the cortex. There they multiply and the cortical cells are stimulated to increase in number. The multiplication of the cortical root cells, resulting from the bacterial invasion, causes the root swellings known as nodules.

In the absence of nodule-producing bacteria, legumes possess no more capacity for fixing nitrogen than any other plant. It is therefore important that the proper strain or species of bacteria be present in the soil if the symbiotic process is to be effective and if the legume is to perform its full function in soil maintenance and improvement. Many soils do not contain the proper inoculating organisms and it is necessary to inoculate the seed artificially from fresh cultures of the particular strain of bacteria required. Seven groups of legumes have been recognized, each of which is

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susceptible to inoculation by specific bacteria. They are the alfalfa, red clover, vetch, bean, lupine groups, cowpea and soybean.

Legumes are not entirely dependent upon the symbiotic process for their nitrogen. In fact, even when inoculated, legumes obtain part of their nitrogen from the soil. They can grow in rich soil without forming nodules and fixing nitrogen. Under these circumstances, all the nitrogen required for growth is obtained from the soil. In general, it may be said that under average conditions, in a soil of moderate fertility, a well-noduled legume crop will take about two-thirds of its nitrogen from the air and one-third from the soil.

Estimating from available figures, a two-ton per acre yield of red clover, alfalfa, crimson clover, vetch, or cowpeas would collect in the top and roots approximately one hundred pounds of nitrogen from the atmosphere. Where the hay crop is harvested, however, an amount of nitrogen somewhat greater, in most cases, than that taken from the air by fixation is removed. The turning down of legume stubble cannot be depended on to increase greatly the nitrogen level of the soil. To add nitrogen to the soil it seems desirable to plow under a legume as a green manure some time during the rotation. Pieters, in his book on "Green Manuring," has quoted estimates of Whiting and Fred to show that if no more than 50 pounds of nitrogen per acre were fixed by the symbiotic process and 10 percent of the cultivated land in the United States were planted to a legume crop, 920,000 tons of nitrogen would be added to the soil every year. When you realize that the total nitrogen used in commercial fertilizers annually is only about 400,000 tons, the importance of the contribution of a wider use of legumes in soil conservation is at once apparent.

When it is fully realized what these microscopic bacteria that live in association with legumes can do, the legume will find even wider use in soil conservation work. Saving in fertilizer costs, stimulation of grasses, increasing the erosion-resistant character of vegetation, and providing a better feed for livestock are some of the results. The agronomists, of the Soil Conservation Service and of the State colleges can take pride in having enlisted these minute bacteria as an aid to the effectiveness of soil conservation practices.

What Ails Your Soil!

Condensed from Missouri Ruralist

Soil lacking in necessary minerals and nutrients has ailments just as does livestock —or humans. In the case of soil the symptoms show up in the plants, often as disappointing yields.

Today the soil doctor, with new rapid tests, can determine in a jiffy just what elements are lacking in our soil that prevent it growing thrifty, healthy crops. The "doc" referred to here is the versatile county agent who has just undergone further training in diagnosing soil troubles. The new rapid tests are only the aids in getting at the specific trouble—just as our medical doctors use laboratory tests in locating the cause of our aches and pains.

The case history of the field usually reveals the underlying trouble when the soil is ailing.

The new tests are of two types. One is known as a tissue test. With it plants growing in the field are tested to see whether they are getting all of the required plant foods. This can be carried out in a matter of seconds in the field.

The other test is made with the soil. A sample of soil is washed with a dilute acid and available plant nutrients are carried off in the acid and roughly measured. Note that the amount of available nutrients is measured: food which the plants can feed upon.

Actually, these tests are not too accurate. The soils expert can pretty well tell you what your soil lacks by studying the soil and the growth of the plants. But the tests are a quick and dramatic means of getting at soil deficiencies. And they certainly are convincing!

This summer, training schools in soil testing were held over the state of Missouri for county agents. Almost every agent ordered the kits necessary for running both the soil tissue test and the Missouri rapid soil test. The tissue test is unusually simple to run and can be used by anyone. A mail-order house offers this kit, which was developed by Purdue University.

The tissue test and the rapid soil test used together give more reliable indications of soil fertility than either one of the tests used alone. However, if only one test is used the tissue test is more accurate.

In the tissue test various parts of the plant are used. Indicators, which are chemicals developed

Reprinted by permission from the Missouri Ruralist, Topeka, Kansas, August 11, 1945

for the purpose, are used to determine the presence of nitrogen, phosphorus and potassium, the 3 elements most likely to be lacking.

For nitrogen the main stems and leaf petioles are used. With corn, for example, the indicator is applied with an eye-dropper to the base of the stalk. If the indicator quickly turns dark blue the plant is getting plenty of nitrogen. If the liquid indicator remains clear the plant is not getting sufficient nitrogen.

Tests for phosphorus are made on the main stems or leaf petioles from actively growing portions of the plant. The petiole is the stem of the leaf.

For potassium, with grasses and cereals, tests are made on the base of the leaf near the middle of the stem. For other plants the main stem or leaf stem is used.

In selecting plants with which to make the test they should be typical of the field. Usually, there are several type plants in a field and several of each should be gathered. Usually 6 or 8 plants will be enough but more may be taken if it seems desirable. Samples from these several plants can be cut up and scrambled so a single test can be made.

The rapid soil test, as developed at the Missouri Experiment Station, is to determine the amounts of phosphorus, potash and calcium in the soil which are in a form available for the plants to use.

First, a representative sample of the top soil in a field is taken. Using a soil auger makes this easy but a good sample can be taken with a spade. Dig a V-shaped hole about 7 inches deep at an average place in the field and clean out the loose dirt. Cut a half-inch slice from the smooth side of the hole and transfer to a sheet of paper. Do this in 4 or 5 spots over the field, then mix this soil.

In testing the soil, a leach is first used to extract the available plant foods, calcium, phosphorus and potash, from the soil. The amounts of these plant foods in the extracting solution are then determined by chemical indicators. In just a few seconds it is possible to extract about the same amount of plant food as is made available to the plant during the entire growing season.

Samples taken at different times of year will vary. For example, samples taken in the spring will show more available plant foods than in the fall at the end of the growing season. If a certain plant food is shy in the spring it is certain there will not be enough present for good plant growth later.

By making frequent tests of soil it would be possible to keep

close tab on growing conditions thru the year. The rapid test is a valuable means of checking on limiting plant food elements. It gives no information regarding the other equally important factors necessary for successful crops, such as the tilth, drainage and general conditions of the soil.

Although the soil is the basis of all our farming operations, often too little is known about the way in which plants feed on the nutrients or plant foods in the soil. A highly technical study can be made of these processes but to the average man such a study would mean little. However, anyone can understand the basic principles of soil fertility as explained by University of Missouri soil experts.

Our soil is made up of many small particles of mineral material and organic material. By organic is meant material such as decayed plants that at one time was living. The minerals and organic matter are broken down into finer and finer particles. When available as plant food they are known as colloids, which are even smaller than clay or silt particles. The tiny colloids, which may be a sort of film, are attached to the also tiny clay particles of the soil.

About 5 per cent of the soil fertility is derived from mineral—95 per cent from organic matter. This explains why plowing under such crops as clover is so important. The mineral fertility is important, too, so we apply fertilizer to make up what the soil lacks. However, the total weight of green manure crops is much more than the weight of fertilizer applied.

Most of our good soils of Missouri contain about 2 per cent organic matter. This doesn't sound like very much but this would mean 40,000 pounds an acre! A good green manure crop of say 2 tons an acre would only be 4,000 pounds an acre.

Some soils naturally will have a higher organic matter content than others. Man cannot raise this percentage much higher than nature had in the soil originally.

The fertility available in the soil, organic and mineral, is traded for hydrogen. Hydrogen is the chemical element which makes soil sour.

In this process the clay or colloid particle in the soil acts as a jobber. Surrounding each tiny clay particle are the minerals and organic matter in colloid form. As the tiny hairs on the roots of the plant search thru the soil for nutrients they take in the minerals and organic matter and give off hydrogen.

It's not as simple as it sounds here but this is the basic process. Usually a soil that tests acid has

had the minerals and clay traded for hydrogen until there are few nutrients left on the clay particles. For a soil to be acid it usually means that at one time it was productive and that by renewing the supply of minerals and organic matter, so they can be broken down for plant food, the clay particles will once more have plenty of nutrients.

Think of the clay and colloid in the soil as a jobber, handling hydrogen and plant nutrients. The soil is the manufacturer, the plant the retailer.

One of the plant foods most often missing is calcium. This has been true all over the state. To correct this has been the extensive liming program.

Altho few farms have reached this point yet, it is possible to put too much lime in the soil. Some few farmers have reasoned that if 2 tons of lime is good, 6 tons to the acre would be 3 times as good. This is not true.

The old adage, "Lime without manure makes father rich, son poor," has a basis of scientific truth.

If there is too much calcium in the soil the colloid can take on too much calcium—releasing other plant foods such as potassium and magnesium which go into solution in the soil. With these other nutrients, which are necessary for plants, too, in the soil solution crops are at first given big boosts. But these replaced nutrients are quickly used up, or washed away by rainwater leaching thru the soil Then they are gone and although the calcium remains there is not a balanced diet for the plant in the soil.

Plants, like livestock, need a balanced diet. Too much calcium without other necessary minerals will not grow big crops.

As mentioned, few farms have yet to put on too much lime. But along with the liming, most farms need to add other fertilizers necessary and the soil tests are an easy way to determine what other elements are lacking.

When and Why They Die

Condensed from Turkey World

R. S. Dearstyne
North Carolina State College

MORTALITY in turkeys presents the same problem to the turkey producer that it does to the poultryman. Very often it is the deciding factor as to whether or not the year's work is to be successful and any steps that can be taken to reduce mortality will be of great value to the industry.

It usually happens that as the number of turkeys reared on any one farm is increased, the difficulty of maintaining high livability is increased. Since the present trend of turkey production in the United States is toward larger flocks, it is very obvious that turkey producers are going to have to give the problem of mortality very careful consideration.

It is very clear that there is no single panacea for all of the troubles of the turkey grower. No single rule can be laid down which would insure that if this rule be followed mortality would be held at a low level. The experienced turkey grower fully realizes that he is working with a bird that requires very careful attention, especially during early life. This bird is also subject to a host of diseases and parasite infections, which if not recognized early and checked quickly, may well destroy a large portion of the flock, and the owner consequently suffer a large monetary loss because of this.

Cause	Per Cent of Total Mortality
Blackhead	32.2
Sour crop	18.7
Mycosis	9.4
Reproductive system	9.4
Tumors	8.3
Trichomoniasis	3.1
Crop injury	3.1
Liver diseases	2.1
Kidney diseases	2.1
Pox	2.1
Enteritis	1.0
Paralysis	1.0
Peritonitis	1.0
Coccidiosis	1.0
Prolapse	1.0
Accidental	1.0
Undetermined	3.1

Turkey growers also should realize that the solution of the problem of mortality lies almost

Reprinted by permission from the Turkey World, Mt. Morris, Illinois, Sept., 1945

solely in prevention. Very few of the common diseases of turkeys may be prevented by vaccination. Hence the producer must approach the problem of control on a basis of careful breeding, balanced feeding, and a careful program of management which stresses sanitation. Sanitation is a very elastic term as far as its application to turkey production goes. Many instances exist where a careful observer would declare sanitary conditions very poor, and yet an extremely low mortality rate exists. In other cases, conditions exist which are ideal from a standpoint of sanitation, as far as this can be carried out practically, and yet a high mortality rate exists. Consequently, while sanitation must be stressed, it is only a part of the entire problem.

Young turkeys, when placed under the brooder, are quite delicate and react very quickly to adverse conditions. They do not start on feed and water as readily as chicks, and control of temperature, ventilation and diet must be very careful. It is inevitable that some mortality will occur. As to occurrence of mortality, reference is made to Figure 1. This figure shows the occurrence of mortality at four-week intervals from time of hatch until the birds entered the laying house, the data being taken from two years' records of the turkey flock of the North Carolina Experiment Station. Forty-six percent of all mortality during the period of study occurred during the first 14 days after hatch, and after this time the mortality gradually tapered down to a very low level. As no specific diseases occurred during the first two weeks, it is suggested that this interval might be termed the "critical period" of the poult's life and, if at any time careful attention should be given the poults, it is during this period. *It is probable that most of such early mortality, if a disease such as pullorum does not exist, is of a non-specific nature and probably is related chiefly to weak poults at the time of hatch.*

As to what caused mortality during the 36-week period of study, it was found that blackhead was responsible for 24 deaths, the first case occurring at eight weeks of age, with the greatest incidence of this disease being between the 14th and 16th weeks. Fourteen birds died from the intestinal type of coccidiosis, 5 from crop disorders, 5 from enteritis, and a scattering of deaths were brought about by trichomoniasis, tapeworm infection, leukosis, and mycosis.

The loss of adult turkeys is of consequence to the producer in that a great deal of time, labor and feed are required to bring a

turkey to maturity. Mortality in this study was of particular consequence in view of the fact that all adults were under progeny test and thus represented much more than their meat value. In the data developed, study was made of 96 adult deaths occurring in three years.

As in the case of young turkeys, mortality in adults was caused chiefly by blackhead. This disease accounted for approximately one-third of all deaths. Crop disorders were second to blackhead as a cause of mortality, and there were found 13 other specific causes of death aside from one accidental death and 3 cases in which the cause of mortality could not be determined. Forty-seven deaths were caused by diseases that were definitely transmissible, which emphasizes the desirability of prompt isolation or, better still, prompt destruction of birds showing pronounced devitalization or definite depression. Too much stress cannot be laid on quick action regarding sick turkeys and prompt diagnosis as to cause of mortality where laboratory facilities are available.

In certain sections of the country, reports indicate that late hatched poults can be raised without any great increase in mortality over those hatched earlier in the year. In the southeastern section, reports from many growers and information derived from the North Carolina Station flock indicate that early hatched poults live and grow better than late hatched poults.

While no published reports can be cited to prove that mortality in turkeys either can be raised or lowered by breeding, as has been done with chickens, there is little doubt but that breeding has considerable influence on mortality. Where family records are kept, it is a common thing to find instances where no deaths occur among the poults from some hens, with a high death rate from others.

As an example of the extreme difference which may be found, consider the case of hen No. 90 in the North Carolina Experiment Station flock, from which 24 poults were hatched in 1943. Of these, only eight lived to marketable age. In contrast, there were instances where all the poults from other hens lived to marketable age, although they were reared under the same conditions and with the poults of hen No. 90.

It is accepted generally that all turkeys are very susceptible to blackhead, but difference in mortality among families where blackhead has occurred have been greater than expected, if all were equally resistant to the disease. Likewise, it has been noted

that in outbreaks of intestinal coccidiosis, deaths did not occur at random among the poults of various hens, but at a very high level for some and at a very low level, or not at all for others. Another condition having shown this familiar occurrence is that termed straddle-legs.

This question covers a wide range of ground in view of the fact that there are many systems of feeding and many formulas for mashes which are used by turkey producers. However, it definitely may be stated that the turkey diet should be biologically balanced and that any wide departure from such balance over a long period of time will lead to a lowering of vitality and a probable increase in susceptibility to disease. High vitality, profitable growth, and good performance can be accomplished only when the diet of the birds contains the balance of nutrients necessary to bring this about.

Where standard mashes and a proper balance of grain are fed, it is not likely that mortality is affected by the diet. Where too much grain is fed, however, or where an excess of green feed is eaten on range, the diet may get out of balance and contribute to an increase in mortality.

Hubam's Seven Points

Because of Hubam's high protein content (20% to 22%), Texas feed mills now are dehydrating, grinding, and sacking it for stock feed. Texans call it "the seven-point wonder" because it's a deep-rooted, sub-soiling plant, a legume, a good hay crop, an excellent honey producer, a profitable cash crop, and helps control root rot.

—*Farm Journal*

Indiana "Grinds" Corn Borers

Condensed from Farm Science Reporter

A MACHINE that can be attached to the mechanical corn picker and will kill 95 percent of the European corn borers that are in the stalks at the time of picking—that sounds pretty good.

The agricultural engineers of Indiana Agricultural Experiment Station, Purdue University, report that kind of results in the fall of 1943 and early 1944 in some tests which they made with a machine they have been perfecting in co-operation with the International Harvester Company. The original work in building this machine was done by R. H. Wileman.

The machine is not yet ready for production and it is not available to anyone who might want to buy one. They are not being produced, but the results which these workers at Purdue obtained are promising.

The work in building a machine of this kind was begun in the spring of 1942, and the machine was first tried out in the fall of 1942. On the basis of the experiments made, the machine was changed and improvements made. In the fall of 1943 and the early part of the winter of 1944, it was used on a much larger scale and careful counts made in co-operation with Purdue entomologists to determine just how effective the machine had been in killing borers.

A series of nine tests was made under different field and stalk conditions. The first tests were made Oct. 18, 1943 and the last of them for that season on Jan. 25, 1944. The average borer kill for the nine tests was 95.3 percent. The percentage of kill in the nine tests was very close, ranging from 94 to 97 percent.

Briefly, the machine uses the hammer mill principle so that it pulverizes the stalks. The rotation of the hammer cylinder is opposite to the direction of travel of the machine and is adjusted to just clear the ground. With this arrangement the lower part of the stalk is pulverized as the machine moves into it, and the remainder of the stalk is fed into the hammers by the snapping rolls. A section of hammer mill screen is provided to the rear of the cylinder to serve as a concave for the hammers to work against in pulverizing the stalks.

Reprinted by permission from Farm Science Reporter, Ames, Iowa, July, 1945

Aside from giving a high corn borer kill, the work of this attachment leaves the stalks in such a condition that they can be readily disked into the soil or plowed under. The material which it turns out is considerably finer than ordinary shredded fodder.

On 16 acres where the machine was used, the ground was double-disked and sown to wheat as soon as the corn was picked. Another 20-acre field was allowed to lie over winter and was then double-disked and sown to oats and alfalfa. In both fields a nice seedbed was obtained—there were no stalks to bother the combine or binder when the small grain and hay crops were harvested.

It appears that the work of this type of pulverizer has many advantages and its use, aside from corn borer control, might be profitable and beneficial for any farmer using a corn picker.

Manure Is Good Feed!

Farmers have always put hogs behind steers to pick up undigested corn. But now, it has been discovered the hogs get valuable protein feed from the manure itself. They also get some valuable B vitamins.

At the Universtiy of Wisconsin, five different protein supplements were compared in feeding hogs. All of the hogs got yellow corn, soybean oilmeal, 5% alfalfa meal, ground limestone and iodized salt. The five supplements which were added were (1) 5% ground alfalfa hay and cow manure fed separately (5 pounds per pig daily); (2) 5% ground alfalfa hay; (3) 15% ground alfalfa hay; (4) 2% dried corn distillers' solubles, and (5) 2% dried brewers' yeast.

The fastest gains were obtained with the supplement containing the 5% alfalfa and cow manure. The pigs were more thrifty and had better appetites.

Because of the evident value of cattle manure, the Wisconsin scientists are wondering if it might not be a good idea for dairy farmers to let their pigs run in lots and pastures (much as running them behind steers). Or if this isn't possible, to *haul the manure to the pigs.* It's worth thinking about.

—Farm Journal

Washes Separator by Quick Method

Condensed from Kansas Farmer

TIME- and energy-saving methods and devices are popular with women everywhere. Washing the cream separator is an endless chore, a "must" that can never be avoided, even postponed. Anything that can be done to shorten the job is a boon to the busy farm homemaker.

Mrs. Homer Milbourn, Eldorado, Kansas, uses the 2-minute method which involves use of a wetting agent. Certain routine steps must be followed carefully if the new technique is to turn out well.

First, Mrs. Milbourn allows all the milk to leave the supply tank, stops the crank and rinses the supply tank with a cup of warm water and shuts off the faucet. Then, directly over the float, she adds 1 pint of warm water to clean the machine of cream. Next, she puts 1 tablespoon of the wetting agent in the supply tank and follows this with a pail of warm water — 120 degrees — just too warm for the hand. After this dissolves, it goes thru the separator while the bowl is running down. While it is running thru, she brushes the inside of the tank and the cream and milk spouts.

So far, this is a hurry-up job—the quicker the better. Now, she pours the solution from the machine into a dishpan and dismantles the separator. The float and the covers go into the supply tank. On opening the bowl, the disc will usually be clean, but occasionally there may be a slight smear on a disc. If so, she puts them down in the water and runs the brush thru them. She looks them over well and puts them into the supply tank. The slime on the remainder of the parts is soft and is easily brushed off. After all the parts are in the tank, she pours on a kettle of boiling water and drains them so the parts will dry rapidly.

The wetting agent has the advantage of working well in hard water, leaves no fatty residue or mineral deposit and rinses out freely. There are a number of popular brands which may be purchased in most stores.

Mrs. Milbourn admits that she does not finish in exactly 2 minutes, but agrees that the method is an enormous help in getting a tedious daily job done well. It is an enormous improvement over the old time-honored routine followed by so many.

Reprinted by permission from Kansas Farmer, Topeka, Kansas, August 8, 1945

38 Tons of Pork Produced by 35 Sows In 183 Days!

Condensed from Hog Breeder

Howard Davidson
Ohio State University

PUREBRED sows and purebred boars were behind the phenomenal record made by Alvah Henry of Clinton County, Ohio, in producing 38 tons of pork from 35 sows in 183 days! He marketed 318 hogs from 35 sows at an average weight of 242 pounds each when they were just 3 days over 6 months old!

Henry's sows are not registered, but they are purebreds. The usual practice on that farm is to crossbreed. Registered Poland China boars are used on purebred Duroc sows and gilts. Gilts are added to Henry's herd every 2 years, the result of mating his very best sows with a registered Duroc boar.

This high producing Ohio commercial herd didn't just happen. It has been built up over a period of years through selection until Henry now has a bunch of sows that are prolific, that farrow big husky pigs, that produce plenty of milk to get them started; and that are such excellent mothers that they raise most of the pigs they farrow. Remember, the Henry sows must prove themselves superior brood sows before they are mated to a registered Duroc boar so that their purebred gilts can be added to the herd.

The brood sows are wintered in an alfalfa field located about 80 rods from the farmstead. Their winter quarters are inexpensive portable sheds, three of them arranged to form a U with the court opening to the east.

These sows are the type that we all like to think of as being broody. They are big and rugged, and yet are not leggy or coarse. They are a trifle longer than most Duroc sows but they have a lot of depth, too I believe they have the best udders on them of any sows I have ever seen, and after all, a sow must be able to nurse pigs if she is going to raise them.

There are three things about this sow feeding program that are particularly interesting. First, the sows are fed at some distance

Reprinted by permission from the Hog Breeder, Chicago, Ill., August, 1945

from the shelters so that they have to take exercise or go hungry. Second, they are given plenty of protein and minerals. Third, the kind of grain used depends on price.

The sows receive approximately a half pound of 40% protein supplement per sow per day and the mineral is fed at the rate of 59 pounds for each ton of feed. The grain part of the ration is usually corn, although some wheat and oats have been fed when the price was in line with corn. The ration is hand-fed so that it can be adjusted to fit the condition of the sows.

Fall pigs are farrowed in an alfalfa field which has not had hogs on it since the last time it had been in alfalfa. Farrowing houses, self feeders, waterers and shades are grouped. For the most part the farrowing houses are the old A-type without floors.

For spring farrowings, the individual houses are cleaned and moved to a clean field of alfalfa. The houses are lined up side by side and corn fodder is banked on the north and west sides to make them warmer. A pen, approximately 6 by 10 feet, is constructed in front of each house out of gates made from native lumber. Each sow is put in her own house with the pen in front a few days before she is due to farrow.

Each litter is kept in its individual house and pen for about 3 weeks. In that way Mr. Henry does not have as much trouble with the older pigs robbing the younger ones. He doesn't use the pens for fall farrowing because he wants both sows and pigs to eat as much forage as they can. He does, however, keep down robbing by scattering the houses all over the field. Little pigs will usually not travel very far from their nest for several days.

Sows are taken away from the pigs at weaning time and this leaves the pigs in the surroundings to which they have become accustomed. There is plenty of self-feeder space and the feeders are located quite close to the water, and both are quite close to shade.

The pigs are started on a grain ration composed of 60 pounds ground corn and 40 pounds wheat. A 40% protein supplement is mixed with the ground feed at the rate of 1 pound of supplement to 7 pounds of grain, and 50 pounds of mineral is then added to a ton of feed. The amount of protein is gradually reduced as the pigs become larger until they are getting about 1 pound of supplement to 12 pounds of grain during the finishing period.

The ration varies, however, with the relative price of the

grains, although Mr. Henry likes to feed some wheat to growing pigs if the price isn't too far out of line.

Yes, everything we have mentioned is important and yet we know of many men that follow similar programs that have not quite been able to approach the record of a ton of pork per sow in 6 months. If there is a secret I fully believe it is in the brood sow herd.

"C" Also a Sunshine Vitamin

Vitamin D is known as the sunshine vitamin because it is produced in our bodies by ultra violet light absorbed through the skin from sunshine. Researches made at the United States Plant Soil and Nutrition Laboratory, at Ithaca, N. Y., demonstrate that vitamin C is also a sunshine vitamin. Tomatoes, as well as the citrus fruits, are a rich source of this vitamin. It was known that the vitamin C content of tomatoes varied with the type of the plant, its nutrition on the soil on which it was grown and other factors. When all of these factors were kept uniform, it was found that the vitamin C content of the fruit varied directly with the amount of sunshine which the plant received during the two weeks preceding ripening.

—*Certified Milk*

Dynamic Kernels

Condensed from Farm Journal

Dan Runnells

A CUBIC inch of wheat is not much grain — about 360 kernels by actual count— but when it's the Lord's wheat, hitched to a tithing program and backed by an inspired Quaker, they become "Dynamic Kernels."

When you add the personality of Henry Ford you have a combination that attracts nation-wide attention, even in wartime.

For five years the nation has been hearing about Perry Hayden's Dynamic Kernels, as they have been produced and tithed, planted and replanted, and harvested and threshed at the Quakers' Little Friends Church at Tecumseh, Michigan, and on Henry Ford's farms near Macon, seven miles away.

Both men are quite as dynamic as Hayden's Kernels, but it has taken the ideas of Hayden (the village miller) and the ingenuity of Mr. Ford to stage an agricultural and religious show which has aroused wide interest.

The story of Hayden's Dynamic Kernels begins one Sunday as the Tecumseh miller sat in a pew in the Little Friends Church. He was listening to Rev. Clifton Robinson of Cleveland, then a Bible student, preach a practice sermon on tithing and the "death route to life," as illustrated by the falling of a kernel of wheat to the soil to die—but later to live and bring forth fruit.

Hayden determined then and there to show that tithing one's income would bring divine blessing upon the tither.

He decided to plant one cubic inch of Bald Rock wheat in a 6 x 8-foot plot in the churchyard. Hayden's fellow-worshippers joined in the project, helping him plant each kernel by hand.

Five plantings and harvest followed. Not one crop failed.

The first crop (1941) planted in the tiny churchyard plot increased 50-fold. The wheat was harvested with a sickle, and the Hayden family clipped the heads from the straw with scissors. The grain was threshed with a carpet beater.

After the church was given its tenth, the remaining wheat was planted each year, until now it's a problem to find land enough for the "Dynamic Kernels."

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For the first five years Henry Ford supplied the fields. In 1943 the crop was harvested with a self-rake reaper from the Edison Institute Museum at Greenfield Village, and was threshed with an 1863 Birdsall separator operated by a five-team horsepower sweep. The acre yielded 16 bushels of wheat (the nearest the demonstration has been to crop failure.)

By last year the crop required 14 acres of Mr. Ford's land, and was harvested with a 70-year-old reaper and threshed with four old-time separators from the Greenfield Museum. The yield was 370 bushels.

This year's crop, grown on 230 acres of Mr. Ford's land, was harvested by a fleet of 20 combines, and brought a yield of 4,868 bushels—enough seed wheat to plant approximately *4000 acres this fall.* The 1946 yield will be possibly 100,000 bushels.

The one cubic inch of Dynamic Kernels has literally outgrown Mr. Ford's holdings at Macon, and he has informed Hayden that he can not furnish land for the sixth and final crop.

Hayden has solved the problem, however. He was greatly relieved when the Lenawee County 4-H Club Council became interested in the tithing program.

The several hundred 4-H club boys and girls will be sold Dynamic Kernels at market price, with an understanding that they will pay a 10% tithe of their increase to the church of their choosing, and contribute another 5% to the Dynamic Kernels Foundation. The Foundation, in turn, will share half its receipts with the 4-H Club Council to build a 4-H dormitory on the Lenawee County Fairgrounds.

In addition to demonstrating that "God's blessings go where God's rules are obeyed," as Hayden expresses it, the Dynamic Kernels have taught some lessons in agricultural science.

Edward Faulkner, author of "Plowman's Folly," has been interested in the project, and this year only a part of the land was plowed before seeding. Wheat on the non-plowed land appeared to be as good as that on the plowed soil.

Besides Mr. Faulkner, the project also has attracted agronomists, seedsmen and farmers from many states, anxious to see the results for themselves, and to hear the churchmen and farm leaders in the pre-harvest meeting echo one another in saying "blessed be the tithes."

The Quarter Horse

Condensed from Farm and Ranch

Hazel Cooke Upshaw

WHEREVER cowmen congregate the talk is sure to get around to horses, because a good cow pony is about the nearest thing to a cowboy's heart.

That's why the breeding of quarter horses has attracted so much interest throughout the cattle country. From earliest ranch days, cattlemen just bought a good pony wherever they could find one, then trained him to work cattle. Some cow ponies have more sense than lots of men, but horses like that are hard to find. The characteristics most needed in a ranch horse have been bred into the quarter horse for several centuries, which explains why it's cattlemen, much more than professional horse breeders, who are producing some of the finest quarter horses today.

A cowboy wants a horse fast enough to catch a calf in a few jumps, stout enough to hold the toughest steer. He wants a horse with sense and stamina. He wants a horse with a short back and strong straight legs, a horse wide between the eyes. That's the quarter horse.

It isn't a new breed at all, it's really an old and distinguished line that has recently found a new and important purpose in life. The quarter horse was originally known as the American quarter running horse, established in Virginia about 1665 and the breed was developed enthusiastically by Colonial landowners whose pride in their stables was unbounded. Even then the quarter horse was short-coupled, heavily muscled inside and outside, with a broad muzzle and heavy in the rear quarters, "plenty of breeches," as horsemen say. It was Virginia plantation owners who first popularized short races with their fine quarter horses.

"If he can't run he's counterfeit," they said in that day, and they say the same thing today.

The term "quarter horse" does not signify that the animal is one quarter of some breed or other. It simply means that he was bred to run his best in the first quarter of a mile. Peter McCue, who established the famous Peter McCue family back in 1899, stretched out to a quarter mile in twenty-one seconds. It is the same power that he put behind that

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first few jumps that makes the breed invaluable in ranch work. Peter McCue II established the line in Colorado, and another son of old Peter, Sheik, was bought by the Matador Ranch in Texas, while a third son, Jack McCue, started the line in New Mexico.

Old Billy, sire of the famous Billy family, was bred in Gonzales county, Texas, and purchased by W. B. (Billy) Fleming, Belmont, Texas, soon after the Civil War. Lock's Rondo, the original Rondo of that family, was bred by Charles R. Haley, Sweetwater, Texas in 1884. Old Cold Deck, founder of the Cold Deck family, was bred by Tom Martin, of Kyle, Texas, in 1868. The story of Traveler will probably never be proved, but it is said that he was shipped to Texas in a carload of horses, was won in a crap game, and finally sired the well known Traveler family. Sykes Rondo, sire of the Sykes family, was bred at Nixon, Texas, and Old Joe Bailey, sire of that line of champions, was bred by Dick Baker of Weatherford, Texas. These are only a few of the Texas bred quarter horse families, and they are only a part of the fine lines being bred throughout the southwestern states.

A quick take-off is an outstanding characteristic of the quarter horse and another equally valuable trait is its ability to take sharp turns, to follow in close to a dodging calf, but it is his quiet, even disposition that makes him handle so well on the range.

There's certainly nothing temperamental about a quarter horse. Watch a highly trained show horse. He's usually as temperamental as a prima donna; he's trained to put on a show and he never forgets, not even for one minute, to put on a good one. But it is characteristic of quarter horse shows that the horses go quietly through the show ring routine, stand well, for the most part, for the judging, handle easily, show to the best possible advantage. These are traits that are typical of every good old cow horse. There's not a bit of boast or brag about him. He just jogs across the range with one eye out for gopher holes and the other on the cattle.

That does not mean that the quarter horse lacks class. Buckskin Joe, owned by Ramon Wood of Henrietta, Texas, when he was grand champion stallion at Ft. Worth this year, sold for $25,000 to Morris Clark of Sheridan, Wyoming. The stallion, a five-year-old, standing at 14.2 and weighing 1,100 pounds, had been running off with honors at previous shows, among them the Wichita County Show, but of course a horse's prepotency is of as great importance to the breeder as his

ability to win ribbons for himself, and three of Buckskin Joe's colts were right on his heels through all the shows, winning honors for themselves in other classes. This is a true quarter horse characteristic, that he passes his good traits on to his get in marked degree.

But if a cowboy thinks that the quarter horse is exclusively the answer to a cowboy's prayer, polo players are no less certain that he was bred especially for the polo field. After all, the same traits that make a horse tops on the range make him star of a polo game. Quick get-away, the ability to stop and turn on a dime, instant response to his rider, that's the quarter horse.

Billy Fleming, Sykes Rondo, and Little Joe blood lines are said to be responsible for the fact that Texas raises 94% of all polo ponies in the United States.

Add rodeos to the list of places where the quarter horse exactly fills the bill, and you will understand why the number of breeders is increasing rapidly. While the history of the quarter horse can be traced clearly to Colonial days, the breed has been subject to registration only since 1940, when the American Quarter Horse Association was organized with offices at Eagle Pass, Texas. To date, 2,100 horses carrying the established blood lines have been registered, but the list is growing fast for the quarter horse has a job to do, and he's doing it in a big way. He's the world's finest cow pony.

Fogging Out Bugs

A new idea in farm insect control, applying DDT as a fog through Navy fog generators, was demonstrated the day on the Bumstead Tal-wi-wi Ranch in Maricopa County, Arizona.

A 5% solution of DDT in an oil base chalked up a near-perfect kill of leaf hoppers on grapes, and on citrus thrips.

Fog generators used by the Navy in landing operations were mounted on light trucks. Fog was applied at the rate of 2½ minutes to the acre.

If this method develops, fruit growers may have a cheaper, faster way of killing insects. Insect control now costs $3 to $4 an acre.

—*Farm Journal*

What's A Good Pasture Program?

Condensed from American Agriculturist

George H. Serviss

THERE is considerable confusion these days over what constitutes a good pasture program. Many are still clinging to the thought that pasture always means permanent pasture and that improvement of permanent pasture will result in a good program. Sometimes it will, but more often than not it is just a big step forward.

A good pasture program is one that provides all of the green grass that stock can eat from the time they are turned out in the spring until they are brought in in the fall. Any combination of crops that will do this is a good pasture program. This may be an ideal that is seldom completely achieved, but it is certainly worth making a reasonable effort to attain.

Certainly, in the Northeast, we are going to continue to pasture cows and other livestock on much of our present permanent pasture land. There is little other use for it except to grow trees, and a good bit of it can be made to produce worthwhile pasture.

Permanent pasture land that is not plowable can be greatly improved by top dressing with lime and fertilizer. This greatly increases the carrying capacity and improves the quality of the feed. With the establishment of a higher fertility level, many weeds and low value grasses give way to Bluegrass and White clover.

Bluegrass and white clover provide excellent pasturage while growth is rapid, but usually become more or less dormant for several weeks in mid-summer. Combinations of Ladino clover and tall grasses such as brome, Orchard, and Reed Canary, are much more productive during the mid-summer period. Farmers, too, are reporting that high producing cows milk better on Ladino clover-tall grass mixtures than on even good Blue grass and wild White clover.

In planning a pasture program there is one fact that must be considered and that is that both permanent pastures and Ladino clover-tall grass pastures produce half or more of the total feed for the year in the first third of the grazing season. This proportion will vary somewhat one way or the other with climatic conditions.

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It can also be varied slightly with certain mixtures, but no one has yet devised a seed mixture or a fertilizer treatment that will make grass grow at a uniform rate throughout the season. Irrigation plus fertilizer will come very close to accomplishing it, and possibly on many farms a few years hence we may be irrigating a few acres of heavily fertilized pasture to provide this needed summer grass.

In the meantime, though, let's face this problem of one half or more of our grass growth in the first third of the season. It cannot be solved by saving pasture fields until the middle of July. The grass by that time is little more value than straw for feeding. Uncut or ungrazed grass, too, is quite likely to smother out a good deal of the clover. A very early cut or grazed Ladino field can be kept in reserve for some time though, as Ladino does not deteriorate in feeding value rapidly and the second growth of the grass will not be mature enough to have deteriorated appreciably.

Essentially the solution boils down to the fact that we must provide at least twice the acreage for our stock in the last two-thirds of the season as we do in the first third. We must also realize that much of our present pasture acreage is so poor in midsummer that a cow could not fill up in a day no matter what acreage was provided. We must hay part of our pasture acreage in the spring, or graze a good part of the aftermath on our hay acreage in summer, or we can grow an annual pasture crop like Sudan grass. It begins to look as if we will not distinguish sharply on many farms between hay and pasture land in the future, but will use fields interchangeably to take best care of the needs of the stock for the particular season.

To make much of our pasture acreage worth haying in the spring, we must improve it. Fertilizer is always essential for improvement; lime usually is, and seeding to a Ladino clover-tall grass mixture is desirable whenever it is possible to prepare a seed-bed.

We must, too, get the right kind of plants into our meadow if we are going to secure summer grazing from them. The old Red clover, Alsike clover, and timothy mixture is entirely unsatisfactory for such a purpose. Alsike clover and timothy usually produce no aftermath worth mentioning and Red clover aftermath comes on too slowly. Besides neither Red clover nor Alsike can be depended upon for more than one year.

We need more perennial legumes like alfalfa and Ladino clover and more grasses like Brome in our meadows. Ladino may not be perfect, but it has

wide adaptation, recovers quickly after grazing or mowing and might well be included in practically all seeding mixtures that will be used at all for grazing. Whether or not it should be included in a mixture with alfalfa that will be seeded on good alfalfa land and will be harvested only for hay is open to argument. Since really good alfalfa soil is not overly plentiful in the Northeast, Ladino might well go into most hay mixtures.

Birdsfoot trefoil shows considerable promise as a pasture and hay legume. The chief stumbling block to its more widespread use is the shortage of seed of the desirable strains. It is also a rather tricky crop to establish. The problems involved in getting a stand will probably be solved quicker than problems of seed production.

Bigger or Brighter?

Do you want bigger apples or better color?

You can have either one (but not both), thanks to research work at Cornell University.

It has been known for some time that soil rich in nitrogen means larger apples with poorer color. A low nitrogen content means better color, smaller size.

But how was a farmer to tell about the nitrogen in his soil without sending a soil sample off to the state college?

Now, Cornell researchers have come up with a simple color chart that you can hold up to your apple leaves and get a pretty good idea of the nitrogen content of the soil.

The chart, with seven shades of apple-leaf green, thus far has been worked out only for the McIntosh apple.

—*Farm Journal*

Ways to Improve Dairy Efficiency

Condensed from Holstein-Friesian World

STATING that further improvement in the quality of hay and pasture in the region is generally accepted as being essential to low-cost milk production, the committee on Production Efficiency of the Northeastern Dairy Conference gives in a recent report a broad appraisal of the progress that has been made in production efficiency in the northeast. The committee points out a continued trend toward larger herds and the use of more milking machines and other equipment to increase the efficiency of labor on dairy farms.

The report was prepared by a committee headed by L. C. Cunningham, Extension Professor of Farm Management, New York State College of Agriculture, Ithaca.

The report states that 60 to 70 per cent of the nutrients necessary for maximum milk production can be furnished by high quality roughage, a fact too often disregarded by dairymen who are conscious only of the nutrients supplied by purchased grains. The nutrients in roughage can be produced cheaper than grain, and cows will eat more of it if available, providing it is high quality and palatable.

"Emphasis on production, harvesting and preservation of pasture and hay points the way to greater economies in milk production and the growth of herd replacements," says the report.

"The average dairy cow is not fed to her capacity to consume and utilize economically. Cows will utilize larger amounts of feeds if well grown and the feeds are of good quality.

"Contrary to common beliefs, dairy cattle are fed more poorly during the summer grazing season than at any other season. Too much dependence is placed on permanent pastures with little provision for supplemental grazing crops during mid-summer when permanent pastures are dormant.

"Regularity in feeding and management procedures is practiced on a relatively small percentage of farms. Cows are treated roughly and help is often improperly trained in milking and management technique."

Stating that the average useful life span of dairy cows is entirely too short for efficient milk produc-

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tion, the report declares that since the cost of raising replacements is high, it is obvious that greater longevity with more lactations will improve efficiency in milk production. All studies, according to the report, show high producing cows to be more economical milk producers, and that therefore culling of low producing cows is one of the first and most important steps in raising the average production per cow.

The report discloses that 300,000, or nine per cent of the dairy cows in the northeast are discarded annually because of disease, and calls for greater effort to wipe out bovine diseases.

Citing various studies of labor efficiency the report says that dairy farmers can still do much to improve efficiency by the proper use of machinery and planning their operations to reduce the time and energy spent in caring for cows.

Listing outstanding problems, the report says further improvement in the quality of hay and pasture are essential to low cost milk production. The educational job of changing the feeding and management practices is only well begun, and more dairymen need to follow improved practices in raising heifers, conditioning dry cows, managed milking and making maximum use of hay, pasture and supplemental grazing crops. Better bulls is a fundamental problem, and probably in no other phases of dairying is more research needed than in herd health and sanitation.

G. T. Klein, extension poultryman of Massachusetts State College, advises the spreading of five pounds of an 0-20-20 fertilizer on the dropping boards or in the pits for each 100 hens. The phosphate in this mixture will conserve or preserve the ammonia or nitrogen; and both phosphate and potash add to the fertilizing value of the manure.

—*N. J. Farm and Garden*

Tomorrow's Beefsteak

Condensed from Certified Milk

"Why Not Now" may be your reaction to the following paragraphs released by the U. S. Department of Agriculture:

"That postwar steak, as the scientists picture it, will be tender, juicy and flavorful. Its fat will be creamy rather than pure white and will be distributed or "marbled" through the lean, rather than concentrated in an outside layer. The color of the lean will incline toward cherry red. Cuts will have less bone in proportion to meat. Also the nutrition value of the steak will be higher. The steak will come from a line of cattle bred for meat tenderness. Scientists have found that tenderness is a characteristic that runs in families. The steak will come from a relatively young, healthy animal that has grown rapidly, because rapid growth is economical of feed, and generally produces the tenderest meat. The meat will have been ripened for the proper length of time to allow the natural enzymes to break down the tougher tissues and make it more tender and juicy, and at the right temperature to prevent bacterial spoilage. After aging, the meat may be frozen for further tendering. The scientists have found when beef is frozen and stored at low enough temperatures ice crystals split the fibers and make the meat more tender."

"Because pasture feeding is so economical for the producer and also adds nutritive value to the meat, more beef in the future is likely to be grass-fed—or at least fed both grass and grain, instead of being furnished entirely on grain.

"More meat and less bone will be characteristic of beef cuts of the future which will mean less waste in cooking and more food value for the money spent on meat. Breeding studies show that animals may be bred with smaller bones in proportion to meat. Tomorrow's beafsteak will also be cooked by methods that make for tenderness, juiciness and finest flavor, if housewives are willing to do their part toward steak perfection.'

—Certified Milk

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First Milk for Calf Triple in Riboflavin

About three times as much riboflavin (vitamin G) is contained in the colostrum or first milk as in normal milk, but this high level drops approximately 30 per cent within 24 hours after the cow freshens.

These facts, reported in the Journal of Dairy Science, by D. R. Theophilus and O. E. Stamberg of the Idaho experiment station are but two good reasons why it is important that a newborn calf should have all the colostrum it wants as its first food. The colostrum is the calf's birthright, marvelously fortified by nature with certain protective food factors which help the wobbly calf get off to a good start in life.

But all the colostrum a cow can give her calf won't guarantee its survival if it is improperly fed a few days later or kept in a cold or unsanitary pen. Such handicaps caused by man's neglect often are too much for nature to overcome.

Getting back to the Idaho study on influence of breed, feed and processing on the riboflavin content of milk, the following are other reported findings:

The milk of two Jersey cows used in the experiment contained, on an average, approximately 34 per cent more riboflavin than that of two Holstein test cows. But the total amount of the vitamin produced in a day by the Holsteins was approximately 34 per cent greater, because of higher production, than the daily total for the Jerseys.

There was an inverse relation between milk yield per day and the riboflavin content; that is, less riboflavin as production increased. The riboflavin content of morning, noon and night milk from the same cow was practically constant although the milk yields varied widely.

Supplementing a concentrate-dry roughage ration with substantial amounts of sunflower silage increased the riboflavin content of milk 36 per cent within two days, and kept it at a comparatively high level as long as the silage was fed. Supplementing the concentrate-roughage-silage ration with pasture caused no significant change in the riboflavin content of the milk.

Stage of lactation, season, pregnancy, and heat periods caused no discernible influence on the riboflavin content, nor did pasteurization, homogenization or storage of milk for 24 hours at 40 degrees in a dark refrigeration.

—Oregon Farmer

Variations in the Fat Test of Milk

Condensed from Guernsey Breeders' Journal

I. A. Gould

Prof. Dairy Manufacturing, Dairy Husbandry Dept., and Chief Examiner, Dairy Inspection Service, University of Maryland, College Park

SINCE variations in the fat test of producers' milk and cream at the dairy plant probably constitute the chief source of difference between dairy producers and dairy plant operators, laws which deal with the testing of milk and cream have been established in all states. In Maryland, such a law was established in 1935 and is enforced by the Dairy Inspection Service at the University of Maryland. The purpose of this law is two-fold: First, to insure the milk and cream producers of an accurate and honest weight and fat test for these producers at the dairy plant; second, to protect the dairy plant against unjust demands and criticisms concerning weights and fat tests of milk and cream.

Because of the nature of the Dairy Inspection Law, many of the problems which the Dairy Inspection Service is called upon to solve deal with the fat test of producers' milk at the dairy plant. In the solution of these problems it is highly important that the parties concerned be familiar with the fact that variations in the fat test of milk are to be expected; that is, they are the rule rather than the exception. Furthermore, it should be realized that many factors or causes may produce variations in the fat test of milk and that some of these cannot be controlled. There are so many factors, in fact, that in the following discussion it appears desirable to classify them under two headings: (1) Production factors and (2) dairy plant factors.

Production factors: These causes of fat fluctuation in milk are concerned with the production of milk on the farm. Such causes include the commonly recognized ones of breed, peculiarities of the individual cow, and stage of lactation.

It is well-known that the fat test of milk will vary with the breed of cattle supplying the milk. For instance, some breeds, such as the Jerseys and Guernseys, give milk with a high fat content as compared to other breeds such as the Ayrshire and Holsteins. However, it should be recognized that individual cows within any one breed will produce milk varying widely in fat from the average for the breed. In the same herd,

one Guernsey cow may produce milk averaging 4.3 per cent fat as contrasted to another which may average 5.8 per cent. Both of these cows give milk which varies markedly from the normal breed average of about 5.0 per cent fat.

The fat test of milk also will vary with the length of time the cow has been in milk; that is, whether the cow is two months, four months, or eight months past the freshening period. (The condition of the cow at the freshening date may mean an exception to this general rule. Usually, if the cow is fat at the beginning of her lactation period the butter fat test of milk will be comparatively high.) In general, the fat content of milk will decrease from the first month to the third or fourth, followed by a steady increase throughout the rest of the lactation period. Thus, it is generally said that as the lactation period progresses the fat test of the milk will increase. One important point to make in this connection is that the amount of milk produced will vary in the opposite direction (inversely) to the fat test; the longer the period the cow has been in milk the higher the fat test, but the lower the volume of milk produced. This relationship between flow and fat test is fundamental and should be kept in mind when consideration is given to all of those factors causing fat tests of milk to vary which deal directly with the cow and milk production.

Weather conditions are important in causing fluctuation in the fat content of milk. Sudden changes in temperature will produce rather sudden changes in the fat test of milk. The fat test of milk tends to increase when the temperature becomes colder and decreases when the temperature rises. These changes in fat tests with temperature are also linked up with seasonal variations. On the average, milk will test higher during the winter months than during the summer months.

Sudden changes in feed may result in temporary changes in the fat test of milk, although all efforts to permanently increase the fat content of milk by feeding have been unsuccessful. One good example of the influence of feeding conditions on the fat test occurs in the spring when the cows are turned into pasture. At this time the fat tests of milk usually decrease, but there is an increase in the volume of milk produced.

Several production factors which influence the fat test of milk are definitely under the control of the farm manager. Such factors are the period between milking, the completeness of milking, and the care of the cows at the time of milking. In general, a short period of time between milking will re-

sult in less milk but a higher test in the milk than when a longer period of time elapses. Furthermore, the completeness of milking is highly important in influencing the fat test of milk. The first milk drawn from the cow is low in fat, perhaps testing 1 to 2 per cent, whereas the last milk drawn (the strippings) may test about 8 to 10 per cent. Thus, when the cows are completely milked, the highest fat-testing milk may be left behind and the milk obtained will be correspondingly low in fat.

The type of care which is given the cows at milking time is also extremely effective in influencing the fat test of milk, and is closely related to the preceding factor dealing with the completeness of milking. Fright or excitement may greatly affect the "letting down" of the milk by the cow and thus greatly affect the fat content of the resulting milk. Cows are creatures of habit and in certain cases a change of milkers will excite the cow and prevent proper "let down." In this connection, it should be stressed that a uniform milking procedure is highly important and that once the cow is prepared for milking the milking should proceed rapidly. Research has shown that the maximum milk yield, or maximum milk "let-down," results when the cow is milked within 3 to 4 minutes.

Another factor under the control of the farm manager is removal of a portion of the top milk for farm use. Removal of one quart of top milk from a can of 4 per cent milk lowers the fat test of that milk to about 3.6 per cent.

Considerable attention has been given recently by many producers to a comparison between the test obtained by a Dairy Herd Improvement Association (D.H.I.A.) supervisor and the plant test upon which the producer is paid. Such a comparison is not desirable nor logical and should be discouraged. Often, the results obtained by the supervisor are higher than the plant test. This is to be expected on many farms because of the fact that more perfect milking conditions exist on the farm the day the D. H. I. A. supervisor is present; that is the milking procedure is under better control, the milking is more complete, and all of the milk is more likely to be sent to the dairy plant.

The difference between D.H.I.A. tests and plant tests will likely be greater when high fat testing herds are involved and when the dairy farm management is such that milking from day to day is conducted in a non-uniform fashion. Still another reason why it is inadvisable to make comparison between D.H.I.A. tests and plant tests is that the D.H.I.A. test represents only a one-day period.

whereas the plant test is representative of several daily tests.

Dairy Plant Factors: These factors are under the control of the dairy plant operator and concern the sampling and testing of the milk in the dairy plant.

One extremely important cause of inaccurate and variable fat tests of milk is the sampling of the milk in the dairy plant. For this reason all producers should be familiar with the usual methods of sampling. The general practice is for the person doing the weighing to pour all of the producers' shipment into the weigh tank on the scales, weigh the milk and then obtain a sample for testing. In some plants, a small sample is taken from each patron's milk daily and this small sample placed in a bottle with other previously taken daily samples. This main sample consisting of a mixture of daily samples is called a "composite sample," and is prevented from souring by means of a preservative. The composite sample is tested at the end of the sampling period which is usually of about ten-day duration. In contrast to the composite sample procedure, there is the "fresh sample" method. This method consists of taking samples from the producers' milk, usually from 3 to 6 samples per month, and testing each of these samples shortly after it is obtained. There is little to choose between the composite-sample and the fresh-sample procedure if the following rules are observed:

First: The taking of a well-mixed representative sample from the weigh tank. Many weigh tanks are so constructed that the mere dumping of the milk does not bring about complete mixing. Consequently, the milk should be stirred thoroughly either before or after dumping. Acceptable weigh tanks should not have strainers which fall below the level of the milk. It has been found that when weigh-tank strainers are below the milk level the milk cannot be stirred thoroughly and the fat test of the milk in the strainer is considerably above the fat test of the remainder of the milk in the tank.

Second: Where fresh samples are used as a basis of payment, at least five such samples should be taken per month. In general, the more frequently the samples are taken, the more accurate the results for the month.

Third: Proper care of the samples before testing. It is especially important that all samples be held at cold temperatures until tested, and that excessive agitation of the samples be avoided. Low temperature storage is especially important for composite samples since prolonged exposure of such samples at room temperature, espe-

cially in the summer, will affect the accuracy of the results.

Once an accurate, well-kept sample is obtained, the last phase of the plant operation which may affect the accuracy of the test is the testing procedure itself. Proper preparation of the sample for testing and proper application of the Babcock method are essential to accurate results.

Relative to these dairy plant factors, it should be pointed out that the weighing, sampling, and testing of milk is directly supervised by the Dairy Inspection Service. All persons doing this work are examined and licensed by the Service and are expected to conduct themselves with a full realization of the importance of their duties.

Winter Ranged Broilers

Wilbur E. Clark

Condensed from New Jersey Farm and Garden

Did you ever hear of putting eight-week-old chicks in open range shelters on Christmas Day? Or of raising broilers the year round — seven crops a year — on range after seven to eight weeks? Or of a range shelter that houses 250 birds—yet is so light that one man lifts and carries it wherever he wants it?

Chances are that if you've heard of these revolutionary broiler methods you've also heard of Charles Hoytash of Vineland, New Jersey. He's the owner and operator of this successful, if highly unorthodox, broiler enterprise, and a man who not only has startling ideas but is willing to try them out.

It all started back in 1942 because Mr. Hoytash was not satisfied with the returns on his investment on a 2,000-layer egg farm. Sound business principles, he says, require that yearly income equal more than three times the investment—and his egg business wasn't doing it for him. So why not try broilers — with a smaller investment required?

He had definite ideas on broiler raising that he wanted to try out. First, he queried Dr. J. J. Black, then associate pathologist at the N. J. Poultry Pathology Laboratory, Vineland, as to whether chickens could live outdoors the year round in range shelters. Back came the answer that he wanted—that chicken body temperatures are higher than human and they could reasonably stand

more exposure. Mortality from cold and exposure shouldn't be so high.

Actually, not one sound, healthy bird has been lost due to cold or exposure even during last winter's zero temperatures. Some weak or sickly chicks have failed to stand the program, but Charley feels that he would probably have lost them anyway.

To get started on his broiler venture Mr. Hoytash sold the egg farm in East Vineland which he had operated for five years and bought the place on Oak Road over in West Vineland. There were only the house, garage, and small brooder house on the five-acre place when he bought it. The soil was sandy, adaptable to the rearing program he had in mind.

First improvement on the place was the new brooder house, 100 by 24 feet, divided into four pens, 25 by 24. He was no carpenter, but after he had the concrete foundation poured he was able to build most of the building himself, with a little help on the framing and roofing.

Let's take a look now at his method of handling his birds. He buys good day-old chicks, crosses when he can get them. Recently he has been taking any breed he can get because of the shortage of good chicks. Accepted brooding practice, of course, is one square foot of floor space for chicks up to seven weeks. Charley gets by with 1,000 birds in a 25x24 pen, or .6 square foot per bird. His mortality is not out of line, either, averaging a shade under the ten per cent expected by the industry.

With these four pens and the old brooder house, which also handles 1,000 chicks he has capacity for 5,000 in the houses at a time. He uses a combination of one coal and two electric stoves in each pen in cold weather, dropping off one electric in warmer weather.

All chicks stay in the brooder house approximately seven weeks, then go on range to finish. They are sold at 11-13 weeks at 2½ to 3 pounds, depending, in normal times, on market and feed price ratios, demand, etc.

Chicks are started on grain for three days, then get broiler mash as long as they are in the house. On range they have mash before them in hoppers all day, and, in the evening, scratch grain scattered on the ground.

At about seven to eight weeks, in winter as well as at other seasons birds are moved out to range shelters at night. This is the one operation in which Charley has help, Mrs. Hoytash lending a hand on "moving day." Incidentally, one of his worst problems formerly was training young stock to go into shelters.

He started out using the

standard Connecticut-type range shelters. He wasn't satisfied with them for two reasons—he had to hire the extra help or call on the neighbors when he wanted to move them; and the chicks had to be trained to go into them at night to roost. Some flocks, he says, had to be put in every night for three weeks. So he experimented with his shelters, first with more and larger openings, then completely open ends.

By trial-and-error methods he finally evolved the present-type shelter, open on three sides, which he builds himself in six hours at a cost of less than $8 each. They have solved both training and moving problems for him nicely. Because of their extreme lightness, constructed from 1 by 2's, poultry netting, and tar-paper, they must be anchored in case of wind. This is done by running twisted No. 9 wires down from the four corners to "deadmen," blocks of wood buried in the ground.

In winter, cardboard is placed along the sides as far as the peak of the uneven roof. Bags are hung from the short front roof, leaving an opening on each side, and open areaway across the front. When it snows or rains he puts the hoppers in this areaway for partial protection. Roosts are made in sections of wooden slats and run up to a point about 12 inches up on the back roof. This roof runs down almost to the ground, incidentally.

The Hoytash "ranges" are, in reality, fenced-in sand yards. They are never plowed or planted and chicks get no green stuff. He has enough of these yards so that there are always some "resting," or in reserve for a year. The yards are approximately 25 feet square and each has one shelter which handles up to 250 birds. Charley likes the smaller yards because he is able to spot trouble quicker in the small area with fewer birds. Originally he ranged a full lot of 1,000 birds in large ranges or yards, 100 feet by 50 feet.

When birds are sold, emptying a yard, Mr. Hoytash moves the shelter to a new spot, spades up the area where the shelter had been, and scatters hydrated lime. Later he scatters fresh sand over this area and the yard is ready for the new lot.

When chicks leave the brooder house, Charley washes down the inside of the house with a hose and scrubs the plate (wooden frame pieces bolted to the concrete foundation) and the foundation with a brush. Hoppers not in use are scrubbed and placed outdoors in the sun until used again. Litter is removed, being careful not to take too much of the sand floor. He thinks concrete floors might make his part of the

job easier but still prefers the natural sand floor because it may act as a filter and prevent some disease. Too, his litter is always dry, moisture readily seeping down into the sand. For litter he prefers chopped cane, but has used peat moss, peanut shells, shavings, straw—whatever he can get. When the new litter is in place his house is ready for the next lot of chicks.

His method of raising broilers, Mr. Hoytash will tell you, means more work because the houses are cleaned oftener. However, actual time spent in caring for the chickens leaves you envious.

He never starts before 8 A.M., and ends the morning's work by 11 o'clock. In the afternoons, if he has baby chicks, he checks the waterers. At 4 P. M., he feeds grains and mash and checks the water again, and is through before 6 o'clock — that's just five hours.

He has automatic waterers on all the ranges, wrapping the projecting pipes with paper or rags in winter and leaving the water run. If the pans freeze, he has to crack the ice once in a while. The pipes, themselves, never have frozen.

All this leaves him plenty of time for repairs and upkeep, outside activities, and record-keeping. In the broiler business he has found that, you need to know where you stand all the time—which means a good set of records.

Charley's records are thorough and complete, yet easily kept, and give needed information at a glance. In addition to the tables shown, which he carries on a large chart, he also keeps detailed financial records so that he always knows his profits, or if a loss occurs, what caused it.

Not every broiler flock is profitable, as broiler men well know, but if you lose on one, perhaps you win big on the next, due to less mortality, more favorable feed-price ratio, demand, etc. On mortality, Charley keeps a day-by-day record on a chart in each of the five pens. These records enable him to spot unusual losses in a hurry without any guesswork.

So that's the story of the Hoytash broiler farm. Conditions change rapidly in the broiler business and Charley's methods allow him to adjust his operation readily to changing conditions. He knows that some of these methods are well-nigh revolutionary, but they have worked for him—and will, he thinks, for others. And he's thinking, when he says it, of returning veterans who might like to get into broilers without too large an investment.

FOR THE FARMER'S LIBRARY

These books are recommended as outstanding in their field:

A Living from Bees — By Frank C. Pellett, Field Editor of American Bee Journal. Orange Judd Publishing Co., Inc. (1943). $2.00.

America's Garden Book — By Louise Bush-Brown and James Bush-Brown. Charles Scribner's Sons $3.50.

An Agricultural Testament—By Sir Albert Howard, C.I.E., M.A., former Director, Institute of Plant Industry, Indore. Oxford University Press. $3.50.

Animal Sanitation and Disease Control—By Dr. R. R. Dykstra, Dean of the School of Veterinary Medicine, Kansas State College. The Interstate Printers and Publishers. $2.85.

Beef Cattle — By Roscoe R. Snapp, Asso. Prof. Animal Husbandry, Univ. of Illinois. John Wiley & Sons, Inc. $4.00.

Beef Cattle Production in the South—By D. W. Williams, Head, Department of Animal Husbandry, A. & M. College of Texas, College Station, Texas. The Interstate Printers & Publishers (1941). $2.00.

Breeds of Livestock in America—By Henry W. Vaughan, formerly Prof. of Animal Husbandry, Iowa State Coll., Univ. of Minn., Mont. State Univ. College Book Company. $3.75.

Dairy Cattle Feeding and Management—3rd Edition—By H. O. Henderson, Prof. of Dairy Husbandry, W. Va. Univ., Carl W. Larson and Fred S. Putney. John Wiley & Sons, Inc. $4.00

Dairy Science — By W. E. Petersen, Ph.D., Assoc. Prof. and Assoc. Dairy Husbandryman, Univ. of Minn. Edited by R. W. Gregory. J. B. Lippincott Company. $4.00.

Diseases and Parasites of Poultry — By Edgar Hugh Barger, D.V.M., Berkeley, Calif., and L. E. Card, Ph.D., Prof. of Poultry Husbandry, Univ. of Illinois. Lea & Febiger. 3rd Edition (1943). $3.75.

Farm Records — By John A. Hopkins, Ph.D., Asso. Prof. of Economics, Iowa State College. Iowa State College Press. $2.50.

Feeds and Feeding—By F. B. Morrison, Prof. of Animal Husbandry and Animal Nutrition, Cornell Univ. Morrison Press. $5.00.

Farm Management—By Robert R. Hudelson. The Macmillan Co. $2.00.

Farm Management and Marketing — By V. B. Hart, M. C. Bond, L. C. Cunningham, all of N. Y. State College of Agriculture, Cornell University. Publishers: John Wiley & Sons, Inc. $2.75.

Farmers of the World — The Development of Agricultural Extension — Edited by Edmund deS. Brunner, Irwin T. Sanders, and Douglas Ensminger. Columbia University Press. 1945. $2.50.

Forestry in Farm Management—By R. H. Westveld and Ralph H. Peck. John Wiley & Sons, Inc. (1941). $3.00.

Grow Your Own Fruit—By M. G. Kains, formerly with U. S. Dept. of Agriculture; Professor of Horticulture, Pennsylvania State College. Charles Scribner's Sons. $3.50.

Growing Tree and Small Fruits—By H. B. Knapp, Director, State Institute of Applied Agriculture, Farmingdale, Long Island, N. Y., and E. C. Auchter, Chief, Bureau of Plant Industry, U. S. D. A. John Wiley & Sons. $2.75.

How to Raise Rabbits for Food and Fur — By Frank G. Ashbrook, Fish and Wildlife Service, U. S. Dept. of the Interior. Orange Judd Publishing Co., Inc. (1943). $2.00.

Judging Dairy Cattle—By Edwin S. Harrison, Professor of Animal Husbandry, Cornell University. John Wiley and Sons, Inc. $2.75.

Livestock Production—By Walter H. Peters, Chief of the Division of Animal and Poultry Husbandry, Univ. of Minn. McGraw-Hill Book Co., Inc. $3.50.

Livestock Judging Handbook — By Julius E. Nordby and W. Malcolm Beeson, Ph.D., Asst. Professors Animal Husb., Univ. Idaho. The Interstate Printers. $2.60.

Modern Agricultural Mathematics — By Maurice Nadler, B.S., A.M. Dept. of Mathematics, Newtown High School, Long Island. Orange Judd Publishing Co., Inc. (1942). $2.00.

Modern Farmers' Cyclopedia of Agriculture—By Earley Vernon Wilcox, Ph.D., Agricultural Writer, formerly with U. S. Dept. of Agriculture. Orange Judd Publishing Co., Inc. (1944). $4.50.

Natural Principles of Land Use—By Edward H. Graham,, Chief of the Biology Division of the Soil Conservation Service. Oxford University Press. 275 pages. $3.50.

Palestine, Land of Promise—By Walter Clay Lowdermilk, Asst. Chief Soil Conservation Service. Harper & Brothers. 1945. $2.50.

Poultry—By A. R. Winter, Asst. Prof. Poultry Husbandry, Ohio State Univ., and E. M. Funk, Asst. Prof. Poultry Husbandry, Mo. State Univ. J. B. Lippincott Co. $5.00.

Practical Farming for the South — By Benjamin F. Bullock, now Prof. Rural Education, Atlanta Univ. Univ. of North Carolina Press. $2.50

Profitable Poultry Keeping — By H. Clyde Knandel, Prof. and Head, Dept. of Poultry Husb., Penn State College. Orange Judd Publishing Co., Inc. $3.00.

Pork Production—By William W. Smith, Prof. of Animal Husbandry, Purdue Univ. The Macmillan Co. $3.75.

Repairing Farm Machinery—By Ivan G. Morrison, Asst. Professor Agri. Education, Purdue University. The Interstate Printers & Publishers. $1.80.

Seaman A. Knapp—Schoolmaster of American Agriculture—By Joseph C. Bailey, Dept. History and Social Science, Hunter College. Columbia University Press. 1945. $3.25.

Successful Poultry Management — By Morley A. Jull, Professor and Head of Poultry Dept., University of Maryland. McGraw-Hill Book Company. $3.00.

The American Land—Its History and Its Uses — By William R. Van Dersal, biologist in the United States Department of Agriculture. Oxford University Press. $3.75.

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Sheep Production—By Levi Jackson Horlacher, B.S.A., M.A., Asst. to Dean, Col. Ag. Univ. Ky. McGraw-Hill Book Co., Inc. $4.00.

Soil Conservation — By Hugh Hammond Bennett, Chief, Soil Conservation Service, U. S. Dept. of Agric. McGraw-Hill Book Co., Inc. $6.00.

The Farm Primer—By Walter Magnes Teller, formerly with the Farm Security Administration, U. S. D. A. David McKay Co. $2.50.

Weeds of Lawn and Garden — By John M. Fogg, Jr., Prof. of Botany, Univ. of Penna. University of Pennsylvania Press (1945). $2.50.

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